

AVIATION WEEK

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PUBLICATION

April 9, 1956

50 Cents

Fairchild C-123
Gives USAF Wings
To Army GI



The Anti-Missile Missile:
Is Effective ICBM Defense Possible?



Let Freedom Ring!

From the moment the spirit of '76 was born with the *shot heard 'round the world* and proclaimed with the ringing of the Liberty Bell... sounds have played a vital part in our American freedom!

Today, the freedom of every man, woman and child of this nation is inseparably linked with another sound—the protective roar of great new jet aircraft like Convair's delta-wing supersonic F-105A all-weather interceptor.

The modern warriors of the U.S.A.F. Air Defense Command who fly these jet aircraft for your protection never relax their vigil. *Let Freedom Ring!*

CONVAIR

CONVAIR is a division of FINECHILD ENGINE & AIRPLANE CORPORATION

FOR 3000 PSI PNEUMATIC SYSTEMS

**SOLENOID VALVES
REGULATORS
INTERLOCK VALVES**



Model 2001
solenoid valve
10-1000 psi

Regulator shown
Model 2005
solenoid valve
1000-15000 psi

Model 2004
solenoid valve
1000-15000 psi

Model 2006
pressure regulator

Stratos' Western Branch now is turning out solenoid valves and pressure regulators for 3000 psi pneumatic systems. Light, reliable, precision-built, they complement the large group of Stratos pneumatic equipment for aircraft.

Solenoid valves are made in two types, each produced as: normally closed, normally open, and normally closed with manual override. Designed for continuous duty in aircraft pneumatic systems, Stratos 3000 psi solenoid valves are compact, light, and simple to install. Drawing less than 1 amp, they are fast acting (0.020 sec.) and show reliable performance minimum maintained by temperatures of -65°F to over 165°F.

Flow capacities are equivalent to a 0.049" sharp edge orifice for the direct-operated size and to 0.312" for the larger relay type. The solenoid of the smaller model is used in the higher-flow air relay unit.

Both types are available as either complete units—or as core and nut assemblies which can be threaded into fittings integral with the mechanism to be controlled.

Pneumatic Pressure Regulators by Stratos provide a wide range of adjustable downstream pressures and are designed to operate with 3000 psi supply.

The high flow model, with a flow capacity equivalent to a .115 diameter sharp edge orifice, can be adjusted to downstream pressure from 400 to

1500 psi. Downstream proof on this pilot operated unit is 5000 psi.

The poppet-type, medium flow regulator illustrated delivers a capacity equivalent to a .025 diameter sharp edge orifice, adjustable downstream pressure range from 100 to 1000 psi, proof pressure is 1500 psi.

For more complete data on Stratos' 3000 psi solenoid valves and pressure regulators, write to: Stratos' Western Branch, 1800 Rossmore Avenue, Minnetonka Beach, California.

Stratos' Western Branch also makes:

ACTUATORS • COMPRESSORS • SUBCUTTERS • CONTROLS

STRATOS

A DIVISION OF FINECHILD ENGINE & AIRPLANE CORPORATION

1800 First Bay Street, L. A. W. Western Branch, 1800 Rossmore Ave., Minnetonka Beach, Calif.
New York Office, 1000 Broadway, New York, N.Y.

Accessory systems and precision equipment for aircraft



Model 2006
pressure regulator

INTERLOCK VALVE

pneumatic, electric

Pressure: 1000-15000 psi

Flow: 1000-15000 psi

Control: electrically

Interlock: electrically

Weight: 1.5 lbs.

Material: aluminum

Temp: -65°F to 165°F

Pressure: 1000-15000 psi

Flow: 1000-15000 psi

Control: electrically

Interlock: electrically

Weight: 1.5 lbs.

Material: aluminum

Temp: -65°F to 165°F

**FOR
OUTER SPACE...**

AC stands in the very front line of progress with an enviable record of outstanding successes in electro-mechanical research, engineering and production.



OF GENERAL NOTES



from New "Concept-through-
Production" Facility
at El Segundo Division

Thoroughly experienced in the requirements of aircraft systems and working closely with the General organization, the El Segundo staff can quickly solve new problems in design. As soon as the prototype is approved, it becomes a production item in minimum time. Ask the nearest Vicom Application Engineer for further information or write for Bulletin A-3326.

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HONORABLE JUSTICE AND CHIEF JUSTICE OF THE COURT
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Franks responded to the survey questions as follows:

Design, Development, Testing and Manufacturing at a Separate Division of Vickers Incorporated.





The photo depicts a tank constructed of two bonded and mechanical and uses and some means of bonding. The photo shows a view of the tank from the bottom. The photo shows a view of the tank from the top. The photo shows a view of the tank from the side.

MISSILE TANKS called for
Pioneering, too!

**MENASCO
UNIWElds**
PROVIDE FULL
STRENGTH UTILIZATION
IN HEAVY WALL
PRESSURE VESSELS

Missile components, like the overall Missile System, have demonstrated that their designers and engineers operate with fresh thinking and new ideas in order to keep ahead of modern guided missile research and development. A case in point is MENASCO's design and production of air tanks for the Nike missile launching MENASCO's exclusive UniWeld process, an advanced method of pressure welding.

The twelve-inch diameter walls in the Nike tank rise in ten operations approximately 30 square inches of alloy steel. Because the UniWeld exclusive pressure welding process, no laps or welds are needed and the tank becomes virtually a continuous vessel.

Thus, MENASCO's pioneering work in UniWelding of missile tanks has opened the way for the use of pressure vessel applications where high strength walls make the difference.



One of MENASCO's UniWeld machines in operation. This exclusive MENASCO process is gaining wide acceptance in the aircraft and missile fields.

Specialists in Aircraft Landing Gear



menasco manufacturing company

100 SOUTH SAN FERNANDO BOULEVARD, BURBANK, CALIFORNIA



THE WRAPS ARE OFF



The New 680 Aero Commander
WITH LEAR ABUNDANTLY DESIGNED INTO IT

When the high-performance Model 680 "Super" Aero Commander was in the design stage, specific structural and space provisions were made for Lear equipment—complete Lear L-8 cockpit system with automatic altitude control and automatic approach coupler—Lear LYTH-56 vane crystal-controlled 36 channel transceiver—Lear Model 2500 marker beacon receiver—Lear 544-146 automatic direction finder—Lear LYTH-5 vane transceiver system with omni—Lear broadband vane antenna. All these units have been installed in emergency demonstrations, and Aero Design and Engineering Co. officially offers this complement of Lear equipment.

Take a tip from the builders of the great new 680 "Super"...specify Lear!



LEAR

LEARN, CHRYSLER, LTD. 8001 OL, SANTA MONICA, CALIFORNIA

2

During straight and level flight, the precision cam must provide maximum fuel efficiency to ensure the maximum range.

3

During combat, the complex surface of the three-dimensional cam becomes the pilot's most sensitive assistant by instant fuel responding for changes in pressure and temperature.

1

Immediate full power is required for split-second takeoff and vertical climb to extreme altitudes. The Holley three-dimensional cam must automatically compensate for instantaneous changes in altitude and temperature.

How the Holley three dimensional cam functions as an automatic co-pilot

The job of the Holley Power Control for jet aircraft is to *sensitively control* engine power according to the pilot's requirements and, at the same time, make automatic adjustments for split-second variations in altitude, pressure and temperature. The "brain center" of advanced Holley controls is a three dimensional cam which is so constructed that it can adapt itself to all combinations of atmospheric temperature and pressure, from Thule to the

Equator and from sea level to extreme altitudes.

In addition to the automatic compensation made for the pilot by the three dimensional cam, it interprets the pilot's request for changes in power. It's the most important link between cockpit and engine.

The three dimensional cam, like the power control itself, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.



Typical "brain center" of a Holley aircraft engine control. Note the double mechanical systems. Each plays a vital role in automatically adjusting the engine under varying conditions.

HOLLEY
Carburetor Co.

1100 E. Main Mile Road • Los Angeles, California
LEADER IN THE DESIGN, DEVELOPMENT, AND
MANUFACTURE OF AIRCRAFT FUEL METERS/DEVICES



TWIN FEATURES FOR THE TWIN-DEERHOUND are weight saving and rigidity through use of magnesium sheet for the aluminum cowl and struts.

Private planes, too, made with MAGNESIUM

Visual areas of the new Beechcraft Twin-Deerhound are made with magnesium for extra lightness . . . extra rigidity.

Low weight and greater rigidity. Do less weight and cost reduction. These are benefits of magnesium that Beech Aircraft Corporation has utilized for many years. They build an outstanding performance using the lightest of all structural metals. You can do the same thing.

If lighter weight will improve your product, if extra strength will do it, or simplified design and fabrication—then the best choice of metal for you is magnesium!

You'll get prompt attention from your nearest Dow sales office, or the non-chemical contacts, Magnesium Sales Dept., MA 3002, NEEDHAM, MASSACHUSETTS.



LOWEST TRANSPORTATION for jet aircraft is provided in the lightest Twin-Deerhound. Lightweight magnesium construction, especially in a top space of 114 inch—a weight of 1400 lbs.



PARTS MADE OF MAGNESIUM SHEET are indicated by dark areas in this diagram of the new Beechcraft Twin-Deerhound.

you can depend on **DOW MAGNESIUM**





ANNOUNCING NEW SPERRY FLIGHT CONTROL SYSTEM



Boeing B-47 A-130 Automatic Pilot



Douglas A3D S-3 Automatic Pilot



Lockheed C-130 E-4 Automatic Pilot



Boeing B-29 M-4 Automatic Pilot

SP-30 designed for new Jet and Turbo-prop Transports

Sperry's experience in designing and building flight control systems for multi-jet aircraft has enabled Sperry engineers to design the new SP-30 Flight Control System to meet the requirements of the aircraft of the forthcoming jet age. This system is based on an entirely new concept of flight control.

In 1946 Sperry introduced its now-famous Model A-12 Gyroscopic to the airlines. Since that time, this system has been installed in hundreds of DC-3s, DC-4s, Constellation, DC-6s and DC-7s, and is widely used by most of the major airlines.

Later models were designed for many military applications in high-speed jet and turbo-prop

aircraft. By working in close cooperation with the military and the design groups of Boeing, Douglas and Lockheed, Sperry developed flight control systems for the B-47, B-52, A3D and the C-130. Thousands of these aircraft are being flown today by these flight control systems.

With this broad, unparalleled experience, Sperry engineers have now designed the SP-30 to meet the needs of tomorrow's jet and turbo-prop commercial airlines. For further information, write our Aeronautical Equipment Division.

SPERRY GYROSCOPE COMPANY
in New York, New York

DIVISION OF SPERRY RAND CORPORATION

HOW

Faultless

**AIRMASTER
CASTERS
ARE SERVING AVIATION**

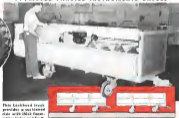
**LOCKHEED AIRCRAFT CORP., MARIETTA, GEORGIA
... MOVES FRAGILE INSTRUMENTS SAFELY**



FIGURE 10000

Illustrated by the Lockheed Corporation, this Faultless Caster is essential for its use in aircraft, in all phases of high speed flight through use of large diameter springs under constant compression, and under low speed in landing, takeoff, and taxiing.

Interchangeable member. Grade of spring steel used in aircraft is not subject to wear, according to Lockheed and Lockheed's research.



This Lockheed track provides a cushioned ride with shock absorber and Faultless Double Ammon Spring Casters.

The Lockheed B-24-42 is a Double Ammon Spring Caster has a unique appearance that maintains a level bed on tracks when moving over irregular floors. Wheels contact floor surface at all times—absorb bumps—don't ride back when entering elevator or drop when passing over depressions in the floor.

How Lockheed Aircraft Corporation, Marietta Division, maintains landing equipment on the B-24's multitude of electronic devices provides the basic information of how your own maintenance problems may be solved. A track was needed to move the equipment's electronic equipment without damage. In order to eliminate their movement and carry the load safely through the production process, the Transportation Department of Lockheed decided upon a heavy-duty load track mounted on Faultless Double Ammon Spring Casters equipped with pneumatic wheels. Faultless Casters were selected since they have fulfilled the requirements of providing a smooth, job done, low cost ride for the electronic instruments. We also solve your other problems, as we have for many in the industry. Simply call your local Faultless Caster Distributor listed in the yellow pages of your phone directory, or write us today.

Two of many AIRMASTER Casters produced for the Aviation Industry



Made in an aircraft with military grade materials for specific use only.



Made in an aircraft with military grade materials for specific use only.

FAULTLESS CASTER CORPORATION
FRANKLIN 7, IND.

Office in Atlanta, Baltimore, Boston, Chicago, Cleveland, Dallas, Denver, Detroit, El Paso, Fort Worth, Houston, Los Angeles, Miami, New York, New Orleans, Philadelphia, Portland, San Francisco, Seattle, St. Louis, St. Paul, Tampa, Washington, D.C., and many other cities.

3 FEATURES EXCLUSIVE WITH AIRMASTER CASTERS



Shock-Absorbing Spring Action provides the most level of trip felt as between the load and wheel as in the case of casters with floor at all times, regardless of rough floors or heavy loads.



Castor wheel of steel and design are easily interchangeable with steel wheels in activities maintenance and "house" use.



Spring Action Caster continues to function as conventional Caster in case wheel load exceeds maximum spring load rating. An important safety factor in load operation.

**Beyond the Point-of-No-Return...
A New Meaning for Dependability**



FIGURE C104



Most Magnetic Amplifier Voltage Regulators now flying are Cline built.

Regardless of the plane or the mission, rugged dependability means everything beyond the point of no return.

Cline Electric supplies new assurance of safe arrival. The Cline Regulator, wide-frequency-range (380-1000 cycles) Magnetic Amplifier Exciter Voltage Regulator, with the USAF B-1 alternator, now in widespread use on the T-28, C-47, and C-124, has logged more hours of dependable flying time than any other military aircraft voltage regulator.

Cline Electric's Magnetic Speed-Positioning Devices have also proved their dependability in handling other complex electronic control problems.

Cline Electric means rugged, trouble-free dependability.

Controls by

CLINE ELECTRIC

BUILDING PRECISION INTO TARGET ZERO

Aircraft Products Division
CLINE ELECTRIC MANUFACTURING COMPANY
3055 West 47th Street • Chicago 22, Illinois



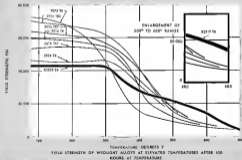
RODOL LTO GLOUCESTER - ENGLAND



W.D.A. Neidhardt: 1 Vernon Lodge - Room 1301 - 333 Fifth Avenue - New York 101



**A new Alcoa® Alloy
for high-temperature
aircraft applications**



Some structural aluminum members now reach temperatures of 600° in piloted craft and even higher in missiles—the result of the aerodynamic heating effect of higher speeds and proximity to engines, de-aerons, etc.

Alcoa is developing new alloys to serve at these higher temperatures. One of the most promising is X3219. We are now offering forgings of X3219 and also rolled and extruded shapes. It will also be available in sheet and plate form, if warranted by demand.

As the chart above demonstrates, X3219 far outlasts conventional alloys in the 500° to 600° range. This chart shows tensile yield values after 100 hours. Tests made after 1,000 hours show the same superiority for X3219. Also, compressive yield strengths do not differ greatly from

| break values, especially at elevated temperatures. |

Physical properties of XCI109

The following methods and typical procedures are applicable to collect and construct all stages up to 4th stage, to separate larger tail specimens and to fix larvae up to 4th stage when the axis of the tail specimen is substantially parallel to the body axis. See also:

Overhead estimate	Type
Tenish strength, psi	50,000
Naresh strength, psi	45,000
Overhead—C, in. 40	4

We expect that X2550 will have an important place in aircraft structural members and also in gas turbine and piston engine parts. With the world's largest light metal forging facilities, we are ready to help you utilize the advantages of this important new alloy.

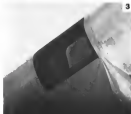
When writing for additional information on Alcoa high-temperature alloys, give operating conditions which must be met. Aluminum Company of America, 1000-D Alcoa Building, Pittsburgh 18, Pa.

ALWAYS FASTEN ALUMINUM
WITH ALCOA ALUMINUM FASTENERS



Your Guide To the Best of
Aluminum Vending





4 hot recipes that do away with icing

Some of these recipes force protection on ice-averse areas like the cockpit. But all of them call for B.F. Goodrich's electrically heated rubber to give just the right amount of heat—no more, no less.

Nowhere else B.F. Goodrich heated rubber fits snugly around the tricky curves and corners on these defense airplane parts. And how the ice problem was solved in each case:

1 On propellers, it prevents ice from reducing propeller efficiency and causing down plane speed.

2 On fuel and exhaust lines, it keeps the KB 59 (Hygon modification), it keeps ice from choking off fuel or oxygen supply.

3 On air ducts, it means smooth flow of air to engine parts and cabin heating systems.

4 On joint seals, it prevents ice from dragging air speed indicators and giving faulty readings on instruments panel.

In B.F. Goodrich's heated rubber, ozone-resistant neoprene sandwiched between rubber plates, gives volume and tensile strength, lightweight unit. It can be easily converted on the part or attached mechanically.

Other heated rubber applications for ice protection or heat control include sensor mats, wing and engine nacelle.

Leading edges, spencer doors, jet engine air inlets, and radar equipment.

If you are looking for the most efficient method of applying your heat, consult a B.F. Goodrich engineer. He'll be pleased to help. B.F. Goodrich Company Time and Equipment Division, Akron, Ohio.

B.F. Goodrich

AVIATION PRODUCTS • Heat, volume control •
Thermal insulation • Fuel control • Radar •
Heated ducts • Engine cooling ducts • Radar •
Powerful air intake • Heat and volume control

Airpower Budget Issues Are Clear

The Fiscal 1957 airpower budget proposed to Congress falls short of meeting the real requirements of the 137 combat wing Air Force program by about \$1.5 billion. The \$18.5 billion Fiscal 1957 budget proposed to Congress for Fiscal 1957 was achieved by Defense Department imposition of a wide variety of one-shot economies that do not represent any legitimate savings but simply postpone the real cost of the 137 wing program until Fiscal 1958.

This is clear from the recently disclosed testimony before the House Appropriations Committee by USAF Chief of Staff Gen. Nathan F. Twining, USAF Secretary Donald A. Quarles, USAF Undersecretary James Douglas, former USAF Assistant Secretary for Research and Development Trevor Gardner and Assistant USAF Secretary for Financial Management Eric Goffick.

Truman-Johnson Cutback

Under staffed questioning by Congressmen, Gen. Twining specifically stated that USAF could live with the Fiscal 1957 budget only if it had assurance of no increase on the order of \$1.5 billion for Fiscal 1958. Since a national election intervenes between Fiscal 1957 and Fiscal 1958 it is obvious that neither the Congress nor the President can give such assurance.

The leaves the Fiscal 1957 airpower budget in the same kind of calculated risk cutback that led President Truman and his Defense Secretary Louis Johnson to reduce the size and effectiveness of the Air Force less than a year before the Korean war. "The \$550 million that Democrats sought to use in 1949 cost the American taxpayer as yet unaccounted billions and a never of American blood."

With that background, the following excerpts from USAF testimony to Congress only this year make the case clear.

USAF was cut \$1 billion in overall procurement (400 planes) by simply ordering only 10 months' production (1,300 planes) instead of a full year (2,300 planes). It was explained as an artificial desire to stoppishly simply postponing the ordering of aircraft, which also means postponing delivery dates to USAF. Undersecretary Douglas admitted this would merely boost the Fiscal 1958 procurement bill higher to make up for cuts imposed this year.

Combat Units Weakened

Gen. Twining testified that Tactical Air Command would be able to operate only 15 of the 25 North American F-100s delivered to each squadron because of the lack of maintenance personnel and funds. He said USAF was getting planes faster than it could put them into operation due to fleet limitations in the maintenance and operations budget.

He also testified that many USAF combat units were far from required levels of combat readiness because of insufficient funds for firing and training exercises. He said every one of his major field commanders was worried about the financial restrictions on training ap-

paratus that was reducing the efficiency level of their wings.

In response to a "put up or shut up" question by Rep. Daniel Flood (D Pa.) Gen. Twining admitted that USAF badly needed more Fiscal 1957 funds for research and development, maintenance and operations and base construction. He admitted the only reason USAF was not pushing for more procurement funds was that it could not effectively operate the new planes it was getting under the current maintenance and operations budget.

Secretary Quarles testified that "I believe our count today is that 30% of our combat aircraft that are most rapid in any one instant will be ready to take off as a combat mission."

It was also made clear that USAF's research and development budget is pre-determined by the Defense Department which set an overall fund total and then allocated USAF a portion.

The details of these one-shot artificial cuts in the Fiscal 1957 airpower budget were revealed along with testimony that showed the countries are facing the most serious challenge in its military history—the rise of Russian airpower.

Vulnerability Increased

Secretary Quarles testified that despite the improvements in our radar warning systems and the Centers' sensor interception expected during the next two years, "A sad realization would be that we are ground under rather than ground in air as the vulnerability of our combat is concerned when the Russians have converted to a heavy jet bomber (the three) " Gen. Twining testified that the Russians not only have more B-50s than USAF has B-52s, but will continue to maintain and increase the advantage of both countries continue their currently planned production rates on this vital type of aircraft.

Trevor Gardner testified that the principle reason for his resignation was "I could not in good conscience participate in a program which had a reasonable chance in my opinion, of losing the technological race with the Russians."

Gen. Twining warned, "While Congress holds the clear evidence of growing Communist airpower there appear to be some who ignore it or who wish that danger would just go away."

Gardner analyzed the present airpower budget cuts as follows: "The rate of technological progress in this country and in Russia is proceeding at a pace faster than the demoralizing process of the (U.S.) government can react to. I think that you will find when the decision making process finally do catch up with the technological progress that has been advanced, that they will come to this particular budget level (\$23 billion) that I am recommending and the only price we will have paid will be a delay of one or two precious years."

We think so, too.

—Robert Holt

STRONG AS STEEL... but 40% lighter!



Shatterproof air-storage spheres by Kidde!

Pressurized air containers—strong enough to handle pressures up to 5000 psi, yet 40% lighter than steel counterparts—have been perfected by Kidde aircraft engineers.

Now available in volumes of from 50 to 5,000 cubic inches, lightweight Kidde spheres retain their physical characteristics at the higher temperatures encountered in today's high-speed aircraft. Made of fiberglass wound in a non-porous liner, Kidde spheres are fabricated on Kidde-designed winding machines which laminate the fiberglass strands in a scientific pattern which equalizes stresses. A special epoxy resin binder gives firm support to the strands and permits the making of a 650 cubic-inch, 3,000 psi sphere weighing only 12½ pounds, as compared to an equivalent steel sphere of 30½ pounds.

Developed for aircraft, lightweight Kidde spheres represent a tremendous stride toward weight reduction of pneumatic system components without any loss in

strength—a vital factor when considered in terms of range, payload and fire power!

In other air storage applications—especially where portability is of prime importance—Kidde spheres afford the same weight-saving advantages. They are the strongest, lightweight containers of their kind on the market today!

For more information about Kidde spheres and how they may solve your compressed air or gas problems, write Kidde today!

Kidde



Walter Kidde & Company, Inc.
415 Main Street, Belleville 9, New Jersey
 Walter Kidde & Company of Canada Ltd., Montreal-Toronto



300
cubic inches



600
cubic inches



900
cubic inches



1200
cubic inches

WHO'S WHERE

In the Front Office

E. G. Cooke and A. V. Linder, senior vice presidents, and, in fact, Timm World Airlines. Also Clyde S. Faltrecht, vice president (general sales manager), Frank E. Black, vice president operations, J. N. Meritt, general passenger service manager. Promoted to regional vice presidents were C. E. McCollum of Chicago, Control Systems, Lewis P. Marshall of New York, Atlantic Express, Richard M. Munnich of Fair, Kenneth Repton, Joseph W. Larkin of Cams, Middle and East Coast, Arthur J. Stewart of Los Angeles, Pacific Coast Region, and R. E. Montgomery of Los Angeles, Western Region. Present Directors of this year's president's office:

Additional TWA promotions (declined) at Keros City: R. W. Bennett, vice president-engineering, R. M. Dunn, vice president-shakedown and maintenance, J. C. Berts, vice president-purchasing. Also, J. Woodrow Thomas of Washington, director of one office shared assistant vice president. So Miles Thomas, who resigned as chairman, British Overseas Airways Corporation (AW No. 26) p. 950, succeeds R. A. D. Nash, Jr., as chairman of British Overseas Airways Limited.

A. W. Lamb, vice president-passenger relations, New York, Air South Co., N. Y. Also, H. R. Douglas, Jr., general sales manager, Washington Section, Watertown, N. Y.

Navy Gen. James E. Briggs to succeed Gen. Hobart E. Brown as Supreme Commander of U. S. Air Force, Australia, on Aug. 1, 1956.

Honors and Elections

Dr. George P. Crampton, USAF, Air Weather Service, was awarded the Distinguished Service Cross for his heroic actions during the crash landing of the T-28A-10 on May 1, 1955, at Fort Worth, Texas.

Paul R. Bowers, president of Paul R. Bowers & Associates, was elected the 1955-1956 President of the American Society of Photogrammetry.

Changes

Elmer H. Olson, engineering director, Associated Divisions, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Also, Charles P. Olson, manager, Oklahoma Division.

William F. Whitehead, engineering manager, and C. Henry Smith, chief engineer, Flight Engineering, Inc., Salt Lake City, Utah.

Robert E. Lamb, West Coast coordinator, Electronics and Instrumentation Division, Radio Line Hamilton Corp., Los Angeles, Calif.

Walter Michol, general manager, Liza Division, Radio Line Hamilton Corp., Union, N. Y.

Mr. Brown, general manager, Vernal Aircraft Company (Canada) Ltd., Vancouver, B. C., also, Alfred P. Taylor, to head Dayton office, Vernal Aircraft Co., Dayton, Ohio.

INDUSTRY OBSERVER

Private industry is building an endogenous aircraft manufacturing plant near Huntsville, Ala. Army Ordnance also plans to build a large new solid propellant rocket plant in the Huntsville area.

Boeing is now offering a scaled down version of its Model 707 Stratojet aimed at competing with the Convair 440 (see p. 99) in the subsonic field. Boeing's transcontinental and trans-Pacific version of the Stratojet weighs in at 100,000 lb. gross weight but the new scaled down version is in the 80,000 lb. gross weight class, close to the maximum planned gross of the Stratojet.

Western Electric is receiving a fixed fee of \$11,979,000 for its USAF Delmar Early Warning (DEW) system. This fee amounts to about \$75 on an estimated contract cost of \$272,500,000.

Douglas A2D turboprop attack bomber program cost the Navy \$14.9 million for its airplanes plus \$39.5 million contract termination costs on an original program calling for 500 aircraft. Navy blamed difficulty with the T40-A-6 turboprop for cancelling the program. Allison is presently doing two A2Ds equipped with the T40-A-6 engine as search aircraft at Indianapolis.

Official Navy statements to the House Appropriations Committee were that the cost of the Navy's Research and Development, Westinghouse Aircraft Turbine Division that the J40-3 and the J40-22A engines to be used in the McDonnell F101B were "unsuitable" and that some of the 197 of these engines delivered to the Navy will be subject to its pricing. Navy says Westinghouse does not concur in its evaluation of these engines.

Allison Division of General Motors is working on a \$13 million program to improve high altitude takeoff performance of its T-40-A-10 turboprop in the Convair R7E flying boat. Convair also has a \$12 million Allison improvement program on this plane. Navy says deficiency in high altitude engine performance is the main problem left on the R7E. R7E program has cost the Navy \$31 million dollars for 11 aircraft.

Auto rule factory design (AW Sept. 12, 1955, p. 32) has been retroactively cited as F-101 supercritical lighter new long manufactured by Republic Aviation Corp. The new design was used on the third phase off the production line which was to be delivered to USAF.

First flight of the Douglas XE-302 prototype is scheduled for late this month from Edwards AFB, Calif. The aircraft is somewhat similar in configuration to the F-40 but is larger and has higher performance.

First prototype of the Suroc SE-210 Cessna jet transport will be delivered to Air Force this month for static tests. As part of the first Air Force will have flight tests in the two jet aircraft powered by 16,500 hp. Pratt & Whitney Avon RA-29 engines. April delivery is somewhat earlier than expected (AW Jan. 23, p. 101) and also indicates that the Cessna will be an excellent carrier seat for military use. It is previously announced. Air Force has 12 Cessnas on order and 12 more on option.

McDonnell has modified its F-104A Voodoo to flight test certain F-101B long-range intercept characteristics.

Vestal H-21C, an Army light helicopter at Ft. Rucker, Ala., has hovered at ground height of slightly less than 17,000 ft., useful load of more than 8,000 lb.

A new variety of gas turbine, the differential gas turbine, is in the early-stage design stage. It may be used in certain helicopter and turboprop applications where fuel economy at partial load is desired, according to its designer, D. W. Hatchinson, Massachusetts, N. Y. Special feature is compressor and turbine shaft have been retrofitted with differential gearing to drive shaft.



Progress is a byword with National Airlines. Their four-engine DC-7As, shown above, offer comfort in speed, because of the 1000-hp GE-6 below—has an important place in the company's future plans. This current subcommittee on engines is expected to be in service by 1956.



W. E. Norris, Manager of Communications, National Airlines, Inc.

Soapy

"G-E 5-Star Tubes give National noise-free communications...and they cut our costs!"

"One reason we install G-E 5-Star high-reliability tubes at the first they have very low maintenance. They give crisp, clear radio reception, and messages are easily understood the first time. This usually does away with time-wasting repeated transmissions."

"Also, we save in two ways with 5-Star Tubes first, we obtain more hours of tube service, which cuts our replacement costs."

"Second, 5-Star dependability means we need to carry less reserve electronic equipment in airports. You see, there isn't enough time during normal short layovers to service flight equipment that has failed. . . . new

units must be installed complete. Trustworthy tubes and equipment help us keep down maintenance."

"Finally, we gain because the reliability of G-E 5-Star Tubes in airborne navigation and other equipment helps National Airlines to meet schedules. This means and holds passengers for any airline!"

5-Star Tube benefits, proved by National, are available to you. Your local G-E tube distributor stocks these special high-reliability receiving types. Please fill today! Tube Department, General Electric Company, Schenectady 5, New York.

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GE-6

Washington Roundup

Snork Flight

Last week's disclosure that the Northrop Snark has flown 2,000 miles may have been made in response to a question from Congress. But not without Washington's consent.

"They proved a jet engine can fly 2,000 miles without fuel."

Possible explanation for the disclosure is found in the House budget hearings, where Rep. Donald J. Flood (D-Pa.) questioned Richard B. Robertson, Deputy Secretary of Defense. Speaking of the ballistic missile Robertson said "We are in a position to fly [Snark] distances in the immediate future." Later, Flood suggested that he do so, the next Saturday morning from the Washington plane. Robertson immediately made clear that he meant to speak of the jet-breathing missile not the ballistic missile. Flood came back with his challenge again: go not and do it by the end of the month. Now it has been done by the jet-breathing, jet-supplied Snark, a missile that was designed almost 10 years ago.

Now USAF planners are saying that Snark should not go into full production except possibly in a stopgap weapon.

The Northrop missile is a jetless bomber, subsonic but relatively cheap. Range is supposed to be 5,000 or 6,000 miles in most of last week's publicity was the fact that USAF doesn't have a 2,000 mi. test range. Information now is being provided for 1,700 miles out of Cocoa, Fla., indicating there has been no need for a larger one (AWM, May 12, p. 100).

'Crash' Train Technicians?

The Congressional Science Subcommittee on research and development focuses on the shortage of scientists and engineers in the U. S. with a comprehensive report detailing the training program of the various nations of the world. The subcommittee's chairman, Rep. Melvin Price (D-Ill.) stressed that it shows "the enormous effort by the Russians in the training of engineers and scientists and the untimely effects of our own careless lack of effort in the area."

"Many warnings have been issued, many speeches have been made. . . .," Rep. Price said. "I suggest that the time has come for strenuous measures, the action by the government, by business organizations, and universities, for what might be called a 'crash program' to recruit rapidly and steadily the number of adequately trained American scientists and engineers."

Congressional Actions Due

Early Congressional action can be expected on these matters:

• Nomination of James Doolittle to be a member of Civil Aeronautics Board. Senate Commerce Committee has set a public hearing for Apr. 11 on this nomination, to be followed by an executive session to consider confirmation action. Meanwhile, action on two other nominees—James G. [Joseph] McNamara to the CAB and Charles J. Lorenson to be Civil Aeronautics Board—depends on Sen. Mike Mansfield (D-Mont.), chairman of the Aeronautics Subcommittee. Sen. Warren Magnuson (D-Wash.) full committee chairman, did not refer the Doolittle nomination to the subcommittee.

• Elimination of the 10% importation tax on travel to Canada, Alaska, Hawaii, the Caribbean, and Central America. Legislation is now pending that has been passed by both House and Senate. The main point at issue is a provision in the Senate version that for the tax exemption, travel to Canada and Mexico must be from points at least 125 miles inside the U. S. The House is expected to accept this. All other foreign travel already is exempt.

• Penalties for sabotage of aircraft. Legislation authorizing the death penalty for the improvement for sabotage to commercial carrier aircraft resulting in a death has passed the Senate and been approved by the House Commerce Committee. There may be some opposition in the House. House-Boeing Industries Committee proposes that the coverage of the penalty should be extended to general service aircraft.

Competitor for F-27

Civil Aeronautics Administration would be authorized \$15 million to finance up to one half the cost of development of prototype aircraft for local service operations, under legislation introduced by Rep. Carl Albert (R-Calif.).

The bill is pending before the House Commerce Committee, of which Albert is a member.

CAA financing would be limited to \$12.5 million, or 80% of the total cost, whatever is lower, on any one prototype project. The program represents a \$15 million development program for a local service plane to compete with the Dutch Fokker F27, which has been licensed for production in this country by Fitchfield Regime and Airplane Co.

More Baggage?

Rep. Carl Albert (R-Calif.) has opened a drive in Congress to get the 40 lb. limitation on domestic baggage moved to the 55 lb. allowed for international air travel.

An Transport Act committee then would cost the scheduled carry-on-trunks and luggage about \$10 million annually in extra baggage fees.

In a floor speech, Albert objected that the 40 lb. ceiling was set in the era of much smaller aircraft, when weight was a major concern, and that this conclusion now is outdated.

"How safe can we be?" he asked. "A C-47 can hold over the U. S., at 40 lb. in a hold for 40 hours [Bristol], carrying 66 lbs. and the only difference between last and the Amazon is that he flies over the 90 miles of the Gulf."

Airpower Investigation

The Armed Services Subcommittee headed by Sen. Stuart Symington (D-Mo.) plans to begin its investigation of the sequence program with hearings, probably late this week, to develop facts of the broad picture—such as the adequacy of the 137 wing program. In its mission of audit and analysis, the subcommittee is expected to cover Army and Navy programs, as well as that of the Air Force.

—Washington staff



PARACHUTED C-123: USAF BUS FOR ARMY GI.



USAF Ready to Carry 'Walking Army'

By Claude White

Audubon AFB, Okla.—USAF's 309th Troop Carrier Group Assault (Fixed Wing) will begin first base for Desert Troop, later this month, ready to put the rolling Army into the air. The group is part of the 463rd Troop Carrier Wing, commanded by Brig. Gen. Cecil H. Childs.

The 199th's commanding officer, Col. William C. Bentley, is confident

that he is not running an ordinary air base operation.

He says his new Fairchild C-123 assault transports are "built and operated for the desert, not for flight performance and maneuvers."

"We have developed a new method of moving the GI," Col. Bentley told *Audubon Voice*, "and it is one that we can use with air soldier capable of sitting in a box. Our mission is to land 'em on the assault field, ready to fight."

And they don't need any special training before they come aboard."

The 309th is young, busy and progressing. In a little more than 10,000 hours of flight it has completed an operational service test on the C-123, proved the group's capabilities and worked out Standard Operating Procedures (SOP).

C-123's Capabilities

Major difference between the fixed wing assault transport and other aircraft is that the C-123 is specially built to operate from unprepared landing strips with maximum payload and loading space requirements.

It is difficult to escape the conclusion that the C-123—pending perfection of ground ATOL, retractable landing gear and propeller synchronization—is moving in to the Army's air track. In the same, the C-123 is headed for the role that the transport helicopter was going to fill before its capabilities were curtailed by experience with counter-terror problems.

For outfit into an assault landing area, rotary wings are ideal but expensive.

The C-123 is proving that it can perform the mission at a reasonable cost, utilizing rugged and maintenance experience that is in USAF's backlog. And the equipment is not complicated or delicate.

Consider the fact that the C-123 is a new piece of hardware applied to a new concept of fixed wing transport, and what the 309th has done since it got its first delivery. Col. Bentley's



USAF CREWMEN and Army personnel join in unloading transport onto rough dirt strip.

With C-123

group was selected at this time last July 8 and five days later it went to work shaking down the first two planes.

Removing the Bugs

This ended its Operation Shutdown. In less than two months they did a normal year's work, finished up four and a half days ahead of the calendar's supply schedule. His goal was to fly the first two C-123's upon launch, until the first one had 500 hours and the second 300.

The idea was to uncover all the bugs at once while the 309th operational is the shortest length of time and eliminate most operational testing. The job was finished on Sept. 2. When the 309th goes overseas this month, it will have completed the C-123's first deliveries, it will have an supply requirement table, trained pilots and maintenance crew. The SOP's are complete.

In the same end, USAF has been fortunate.

The plane has a tested power plant, the Pratt & Whitney R-2800-93W, and Hamilton Standard propellers. The design features simplicity, ease of maintenance.

There are, for example, no engine needles and no internal fuel tanks. The engine is bolted directly to the front spar and landing edge of the wing. The cowling cannot be detached, dropped on the ground, blown away by the wind.

They are on the engine, open up like a cargo pod that has been slid into four sections. Fuel is created as



'ORANGE-FIN' cowling on C-123 permit easy access to Pratt & Whitney R-2800 engines.



C-123 ASSAULT TRANSPORT loads in down at dirt as it hits unprepared strip.

Assault Aircraft Glossary

Assault aircraft have brought a new language into USAF operations. The jargon familiar to fighters, bombers, interceptors and even payload groups is insufficient to describe concepts being practiced with the C-119. Here are some definitions, part of the Standard Operating Procedures for Tropic Canyon Assault Operations.

- **Assault Aircraft:** Assault capable of sustained assault operations, characterized by rugged construction, short takeoff and landing roll and ease of loading and unloading.
- **Assault Approach:** A relatively steep short-final glide-down final approach normally initiated suddenly with a steep pitch down and fully extended flaps after passing the Assault Fold made as such a maneuver is to minimize the effects of ground fire around the perimeter of the Landing Zone.
- **Assault Dispersion:** Dispersion effected on the ground or in the air for the purpose of reducing the effectiveness of hostile fire and reducing the size of the target cluster by assault, ground-to-air support.
- **Assault Landing Area (ALA):** A pre-selected area within the Landing Zone, usually open terrain, designated as the operating area for loading and unloading assault type aircraft.
- **Assault Point:** The final staging point of the landing zone where aircraft pitch down on final approach with the assault loading.
- **Assault Takeoff:** The type of takeoff in which maximum permissible power is utilized and the aircraft, nose up, climbs at a rapid rate as practicable to minimize the effects of ground fire.
- **Cautious Flight Dispersions:** Usually in tandem to the next operations objective, as in continuous corridor type operations, clear, monitor and recheck the exact time of loadings and takeoffs of all aircraft assigned as the means to insure proper separation of flights.
- **Initial Point:** A prominent geographical location used as a reference and bearing point for spacing and timing aircraft into the Assault Point.
- **Start Landing:** The type landing made by assault loading in close trail, where the first and all succeeding assault loads from the same point, continue the same trail and form of the landing area is a predetermined direction, such as such a manner as to clear the runway in case it is practicable for ascending aircraft.

as part of Exercise Sepehrush, joint USAF-Army maneuvers held in Louisiana.

Col. Bentley's report from Sepehrush concludes that the C-119 is the ideal plane for its mission.

Workout at Sepehrush

"We have recently operated at front fields which in other machine transport aircraft, including the C-47, would require the reload and..."

He did have some original suggestions for the Army. He pointed out, for example, that the only air piece was not painted as any vehicle or piece of equipment, the 100th was asked to carry. In addition, he drew much to know the great weight to help in proper loading of the C-119.

In one case a dead powered road roller was not loaded for a gross weight of 1 tone. According to the report the vehicle weighed 16 tons empty and eight tons with the roller ball of water, and assumed they were empty, the 100th tried to run to load it. It was discovered that the rollers were carrying more than two tons of dead air.

Other Army equipment, such as pumps and trucks, did not have clearly indicated the size and weight and chain could be broken.

Landing Areas Are Key

In his SOP, Col. Bentley says that in all operations the assault functions and landing patterns will be governed by the size, shape and number of landing areas available. Terrain conditions, parking facilities and the tactical situation also are factors.

Landing areas are classified according to length, width and terrain.

• **Class I—**Usable terrain at least 2,800 ft long and 400 ft wide, assault capable on its element to land in six lines with 30 seconds between each element.

• **Class II—**At least 2,800 ft long and 100 ft wide. Terrain conditions suitable for landing assault at 15 second intervals.

• **Class III—**At least 2,000 ft long and 100 ft wide. Terrain suitable for landing assault at 10 second intervals.

• **Class IV—**Other landing area that may be used for assault operations, including highway and area with unusual terrain features.

Dispersed Taxi, Takeoff

During Exercise Sepehrush the 100th perfected a technique of dispersed taxiing and takeoff for maximum protection against enemy fire. In the SOP, this procedure now has been defined.

• **Reverse taxiing:** Assault line up on the runway, taking taxiway right and left sides. Takeoff at 15 second intervals.



Nord Griffen: New French Interceptor

Nord Griffen is latest French interceptor, designed for vertical climb and a level flight speed of Mach 1.3. Most unusual feature of this plane is the one-mounted horizontal control surface on the 9th type. Prototype is a Suresco Air 101-G rated at about 9700 lb thrust with afterburner. Gross weight of the Griffen is about 52,000 lb. Cockpit is mounted above the wing through

which fuel enters the engine. Two takeoff, two takeoff with one engine 2,400 lb of thrust each for a total of about 48,000 lb. The Griffen made its first flight Sept. 19, 1955, at an altitude of 10,000 ft. It was developed by the firm of Suresco which has since merged with Suresco to form Nord-Suresco. Design was originally called the Griffon. The aircraft is in a class with the T-16, Dassault and Mirage.

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birds off of the engines, featured to the wing by brush shields. The aircraft is also equipped with a canopy.

The C-119 has all the black boxes that require highly skilled maintenance crew and have been equipped with a variety of tools and equipment and bombards to combat standards. It has other things as well—it is about as plain as a freight car.

The assault transport was designed to operate in the field and short haul a large number of men and their equipment into combat areas under combat conditions. It got its start in life as a glider, designed by Michael Bessinger. Fairchild later changed the design, with power plants added, from Chase Aircraft.

Operation Skydown was intended to remove bugs and Col Bentley was successful in finding a few. The nose wheel gear had to be redesigned for increased stability and to ease loading on the ground.

Arm wing equipment did not function properly in the early models. Cabin heat was insufficient in high altitudes.

There has been some discussion of adding insulation to help in this problem and to reduce cabin noise.

Other firms were awarded. The 100th has never had an accident and never changed in design. In more than 3,000 rough field landings there once only was the failure.

'Skydown' Statistics

Here are some statistics from Operation Skydown.

On maintenance for two aircraft flying more than nine hours a day for a total of more than 750 hours.

System	Man Hours
Assault aircraft	2,000
Engine	1,000
Propeller	1,000
Electrical	1,000
Instrument	1,000
Communication	1,000
Control/operation	1,000
Total	11,000

Delivered man hours: 2,000

Total man hours: 11,000

Man hours per aircraft: 11,000

Man hours per aircraft: 11,000

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Man hours per aircraft: 11,000

Man hours per aircraft: 11,000

Man hours per aircraft: 11,000

Man hours per aircraft: 11,000

Man hours per aircraft: 11,000

Industry Report on Salaries, Bonuses

Tables of salaries and bonuses totaling more than \$25,000 annually as reported by five aircraft companies to House Armed Services Investigative Subcommittees are shown below.

McDonnell Aircraft Corp.

[illegible]

Lockheed Aircraft Corp.

Year Ended Dec. 31	\$100,000	\$500,000	\$1,000,000	\$5,000,000	\$10,000,000	\$50,000,000	\$100,000,000
Edward L. Green, President	1,000,000	5,000,000	10,000,000	50,000,000	100,000,000	500,000,000	1,000,000,000
Robert J. Green, Executive Vice President	500,000	2,500,000	5,000,000	25,000,000	50,000,000	250,000,000	500,000,000
John J. Green, Executive Vice President of Finance	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
William J. Green, Executive Vice President of Operations	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
Carl Green, Executive Vice President of Sales	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Marketing	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Administration	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Legal Affairs	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Human Resources	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Information Systems	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Environmental Affairs	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Public Affairs	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of International Affairs	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Research and Development	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Manufacturing	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Distribution	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Customer Service	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Quality Control	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Safety	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Compliance	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Corporate Governance	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Sustainability	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Social Responsibility	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Ethics	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Diversity and Inclusion	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Employee Relations	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Labor Relations	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Health and Safety	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Environmental Health and Safety	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Occupational Safety and Health	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Fire and Life Safety	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000
John J. Green, Executive Vice President of Emergency Management	250,000	1,250,000	2,500,000	12,500,000	25,000,000	125,000,000	250,000,000

Republic Aviation Corp

[illegible]

Douglas Aircraft Co

[illegible]

Convair

[illegible]

Since 1942



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AT&T's CONCEPTION of the BOMARC, long range piston aircraft. Guidance and control of the BOMARC is under development by the Westinghouse Baltimore Division. (Photo courtesy Boeing Airplane Company)

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See it at the Aero Medical Aids Convention in April. Let us show you several exciting new products developed by Scott Engineers for jet service of the future.



TWA, PanAm Mail Pay Cut in Offset Case

Washington—TWA World Airways and Pan American World Airways both have to reduce and pay to the government under terms of the final decision in the Texas Airline Fuel Mail Rate Case. The decision, which settles the offset issue, will mail pay for an eight year period starting in 1966.

The decision is the final move in the long and complex case. The Civil Aeronautics Board issued decisions in the case in 1964 and 1965, but left the offset question for later action. The Supreme Court tried its effect interpretation of the law while the case was pending completion.

The Board said the final decision cuts the government's mail pay obligation to the two carriers about \$20 million below what it otherwise would have been. The final rate producer \$11.4 million for TWA and \$5.5 million for Pan Am.

Combining its other findings with previous ones, the Board determined that transportation amounts to \$5.51, 000 for TWA and \$5.51,000 for Pan Am. At the same time, final mail pay for American Overseas Airlines between 1966 and 1970 was set and the carrier was awarded \$4,987,800 over what it received with temporary rates. Since AOA has merged with Pan American, the payment will go to Pan American. Combining the AOA per cent with the PAA interest leaves Pan American with a net gain of \$1.1 million.

During the period from the start of Transatlantic operations on Feb. 5, 1966 to the end of 1955, the Board found that TWA had \$4,151,000 in earnings available for offset. The carrier's rate

New British Bomber

London—The Ministry of Supply announced this week that it has placed a development contract with A. V. Roe & Co. for a 1,000 mph jet bomber to replace the Avro Vulcan and Handley Page Victor bombers in the early 1960s. The new bomber, to be compatible in size to the Vulcan, is expected to have a combat range of approximately 3,000 miles.

national net was set at \$41,514,000—\$1,952,800 less than it actually received. Actual equipment will be less than that differential because of the income tax adjustments.

The Board found that Pan American's Atlantic and Latin American operations had earnings of \$5,550, 000 available for offset during the period Jan. 1, 1946, to Dec. 31, 1955. Final mail pay for Pan American's Atlantic operations in the period was set at \$75, 754,000, a decrease of \$3,577,000 from payment under temporary rates.

The CAB also rejected attempts of TWA to get reconsideration of a disputed deferred income CAB payment of \$250,000. Since Gary D. Davis would have allowed TWA to argue its case, but the action failed for want of a majority. The Board also dismissed a motion to disqualify Chairman Ross Bailey from participating in the case.

CAB Will Consider NWA Bid for Permanent Route

Washington—The Civil Aeronautics Board has refused to include Northwest Airlines in the proposed Texas Pacific Railroad Case, but it has agreed the subject of quick action on its new bid for permanent international certification.

Northwest had asked the CAB to maintain the permanent certification case to the President when it made the White House a new decision on Pan American World Airways' application for a Texas Pacific route to the Coast.

The Board pointed out that the White House had heard the request case to the issue of Pan American's application and that Northwest's request couldn't be included.

But the Board said Northwest's permanent certification application for jet leaving conference in an independent proceeding. The Board said it is clear that seriously was a crucial issue in the President's original decision to approve Northwest's certificate for service west instead of permanently. Since NWA is now off subsidy, the CAB feels the action should have no immediate opportunity to present its case.

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CHANCE VUGHT AIRCRAFT inspects checks situation in after section of the Navy's F8U-1 Crusader. Note the use of vertical tail



New Design Details Of Chance Vought F8U



NAVY ARTISTS showing design F8U-1 as it would appear in combat. Building for cockpit position here from left from left to right



FISH-LIKE FUSELAGE and thin wings of the Crusader are highlighted by this in-flight view of the supersonic Navy interceptor



CRUSADER'S variable-sweep wing, upper half, suggests wing's leading edge folds up, greatly inward over span



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Engineering
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at Mach 20 is burning at a speed of approximately four miles per second to make the integration of the 50-millisecond interval, must be fixed when the inert missile reaches a distance equal to the 50-mi limit plus the distance to be covered by the inert missile during the autonomous flight time.

For the case of the Mark 20 cruise missile there is enough time at 50 mi plus four times the autonomous flight time.

For a 50-mi autonomous range, the distance must not be about 274 mi, for the 20G action. The fixed point is when the inert missile is 380 mi out.

Time margin for detecting tracking, plotting and adjusting the microphones can be calculated for the various ratios.

If it is the time required for the inert missile to travel from the 500-mi detection limit to the point at which the autonomous must be fixed to guarantee an autonomous attack, the 50-mi margin zero.

For a 50-mi margin that time margin is only on an even scenario, but for the 20G ratio, the time margin is better than half a minute is enough that some more than adequate for the task.

General Impression

The solution definition of the problem and the approach to its solution can only last at the lead of missile defense system needed to do the strategic task of launching down the ICBM. But even here the basic consideration of the problem, it is possible to augment the lead of a system to do the job.

Most apparent to those of such a system is that the hardware—the only child and its offspring are the lead part of the job. The other direction, com-

munication and computer attributes to the lead and hence of the system and will require the greatest effort.

The inert missile would be comparable to being in the Canadian only a strong line with all the "Nuke" aircraft attack sites, using the own numbers, network established by computer telephone radio and television operations in a "super-SAGE" network.

The missile themselves would acquire enormous thrust weight values because of the high energy acceleration. These values would be probably of the order of several million g's, small enough to fit a package about one foot in diameter. But they would be well against an ICBM, because it would not be possible to guide an air-to-air missile and achieve it at a rough missile.

Similar approaches would be used to defend against the cruise, IRBM, the time limit would be a little tighter because of the shorter flight time of the medium-range missile. This would be primarily compensated by the lower velocity of the missile as its lead ploughs to the target, such speeds would be probably under Mach 10, instead of double that figure.

The most interesting point about these general impressions is that they define the limits of the problem independently of the specific systems required to do the job. But further than that, these numbers show that present-day capabilities of techniques used in missile orders and computer would not have to be stretched too far to accomplish the job-made job.

This is not to say that it is an easy job or one that could be done with existing equipment.

But these numbers indicate that investigation and development of either an ICBM or an IRBM is feasible based on the current state of the art.



Denver Missile Site

Airtec's drawing shows proposed layout for the new Denver Division where the company will conduct its research-and-development program for guided missiles. Facilities include 144-ft. room for the background and forward engineering and administration building, foreman's. Operating vehicles occupy the two buildings.

Contributing precision-made cockpit enclosures to America's air arm



- Complete Enclosures
- Major Airframe Assemblies
- Acrylic Forming and Fabrication
- Jet Engine Sheet Metal Parts and Assemblies
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"Laminum"

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"Now we get a precision fit in a matter of minutes."



"We use Laminum Shims to get accurate spacing between the strut and the tension which holds the landing gear in the wing."



"Laminum Shims simply pecked for adjustment. The fact that layers come in standard sizes makes our job easier and quicker."



"With Laminum Shims it's no trick to meet close-tight spacing specifications between bearing support and lever housing. Every day we're finding new uses."



"Six-inch diameter Laminum Shims are easily sized to exactly .005" in overall thickness. It really saves time over the old grinding-down method."



"To fit ribs exactly into the spar, Laminum Shims are scored into quarters, and varying thicknesses are pecked off each quarter."



"It takes a half hour to file down a solid shim, as compared to minutes to peck laminated shims of Laminum down to exact size."

Of course we knew aircraft producers have been ordering Laminum Shims for years . . . to obtain accuracy, save time and cut costs. However, we weren't quite sure ourselves just exactly how they were applied, nor what advantages appeared most to our customers. So we went out and asked.

Here are the answers—not what we say, but what they say.

"Laminum Shims have done away with grinding and costly unnecessary checking. They've streamlined production. Eliminated metallurgical control action. Simplified inventory. Reduced machining requirements."

"With Laminum Shims the problem of precision fitting is reduced to simply pecking off the layers to the desired thickness. Now we hold tolerances to a thousandth."

"Any application requiring shims of varying thickness is made to order for Laminum Shims."

"To accurately and efficiently control space tolerances in critical placement throughout our aircraft, we have shifted to the extensive use of Laminum."



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NEW DEPARTURE
BALL BEARINGS



AERONAUTICAL ENGINEERING

MIT Probes 'Miles-Per-Gallon' Problem

By Robert H. Coakman

Two answers to the important problem of getting the most miles out of each pound of fuel burned by jet aircraft are being sought by the Massachusetts Institute of Technology's Aeronautics Laboratory.

The first, called an *optimizing system*, automatically takes stuff in flight to get the most miles per gallon from the particular engine-airframe it is controlling. It does this by sensing the correct speed for maximum range and maintaining the throttle near the corresponding setting. It will not be available, however, for another two years.

The second system—called a *semi-automatic system*—should be on the market soon. It presents a group of three easy-to-read instruments which show the pilot how he should fly to achieve maximum range.

Optimizing System

Optimizing, developed by G. S. Dwyer and Y. T. Li of MIT, offers the following advantages:

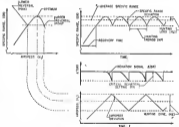
- **Tighter control loop.** The new system is constantly feeding back information, revolutionizing, as it were, behavior. It is, in effect, maintaining itself in flight to make best use of its present conditions. If the surface drag and density went up due to battle damage or dropped because an external fuel store was jettisoned, the new method would account for this change. At present such control decisions are based on data gained from idealized aircraft model tests and test cell runs.

- **Freedom for pilots.** Since the pilot is relieved of awkward fumbling with the flight data manual he can spend more time on overall maneuvering.
- **Independence from accuracy of aircraft instruments.** The system is more concerned with relative than specific values.

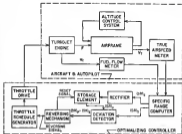
Wash-Limited Aircraft

Optimizing and the *semi-automatic system* will be applicable to contemporary fighters and future bombers alike, though they have enough thrust to spurt into transonic and even supersonic speeds, most stay below the transonic drag rise for efficient cruise.

The system, however, does not apply to older-type fighters and present bombers which are "thrust-limited" as do not have enough engine power to cause them to drag rise in level flight.



PERFORMANCE CURVE for optimizing cruise control using stepped as controlled input.



FUNCTIONAL BLOCK DIAGRAM of typical optimizing cruise control system.



SEMI-AUTOMATIC SYSTEMS* Display allows group of three, easy-to-read instruments.

MICRO precision switches

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MICRO SWITCH has been meeting unusual aircraft design requirements for almost two decades

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What do you want in a small precision switch?

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A complete line of environment proof and hermetically sealed switches with a wide variety of enclosures and circuitry.

Multiple circuit control?

Wide variety of compact switch assemblies for operation by push buttons, rotary selectors, or as toggle or gang switches.

Resistance to high temperatures?

Switch designs in wide range of sizes which are unaffected by temperature changes up to 1000° F.

Push-button operation?

Illustrated herein are sealed button assemblies, two-throw switches, normally open push-button operation, multiple-switch panel mounting assemblies and many others.

Toggle switch assemblies?

Three-position slide button, sealed panel and lever toggle switch, hermetically sealed assembly, multiple indicator/push button assembly, etc. In the long switch assembly line are many other switches and assemblies which have contributed to aircraft design. Among them are many varieties of rotary-actuated switches, door interlocks, heavy duty and high capacity switches. All may be supplied with actuators and circuitry designed to meet specific requirements.

For complete information on these and on the complete line of aviation switches contact the Micro Switch branch office near you.

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French Point Rocket Plane to Mach 1.6

The Suroc 004 Trident, which has reached supersonic speeds in a climb, is in a development program aimed at placing the aircraft's thrust in a level flight speed of Mach 1.6.

Trident's straight winged layout contrasts sharply with France's other interceptor project, the delta winged Mirage III. Moreover for both these planes is to attack expensive bombers flying at high altitudes. The major design requirement is a better high rate of climb, coupled with high altitude maneuverability.

Since engineers chose a rocket propellant as the power source (not located in a pair of turbojets for the low-speed part of the performance range) (although the two types of engines with the aerodynamic nature needed to combine thrust and maneuverability) gave the Suroc designers the unusual Trident layout—short span, straight wings with tapered leading edges and a set of slat tail surfaces that control the airplane about all three axes.

The mixed engine layout, also followed by Dassault in the Siro in the best compromise between the short-range performance aircraft and the longer range, lower performance pure turbojet layout.

Rocket engine of Trident is a three-shafted SEPR 74 engine developing 3,110 lb thrust per cylinder for a total of 6,220 lb thrust. The makers have a hyperbolic (self-igniting) mixture of kerosene and nitric acid. Each thrust chamber can be operated separately or in combination with one other.

Turbojet engines on the prototype are a pair of Armstrong Siddeley Viper, built in France under license by the unit. These engines designed MB 33 develop 1,600 lb thrust each. Developed versions of Trident will probably use more thrust Turbojets. Civilian engines have been suggested in the prototype.

The characteristic wing is straight, thick, approximately 45° thickness chord ratio. It means plan flap on the lower surface. The prototype shows surfaces like others where (known) should be through design are that lateral control is handled by differential operation of the slat tail surfaces, operated by movable areas. Two alternatives are possible. Either the slat surfaces are operated as a position and later down movement, or they are simply "Trident" to give the pilot some feedback stick force.

However, structure was not extra study in Trident, and the French firm says the plane's engine weight is about one-third that of "conventional" selection.



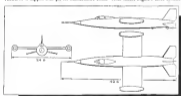
TRIDENT blast through air on power from its three-cylinder SEPR 74 rocket engine



WING-TIP TURBOJETS only develop 3,600 lbs thrust to augment power of rocket engine



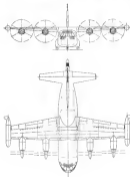
TRIDENT is slipped over pit for maintenance check. Note rocket engine's three cylinders



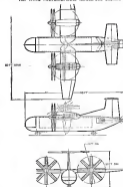
THREE VIEW of Suroc Trident interceptor points up aircraft's strong wing power



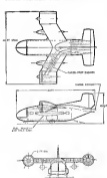
FOUR-ENGINE HILLER would be able to operate out of weak airports as military transport (above). Low-wing layout provides pitch and yaw control while the aircraft is hovering.



TILT WING PROPELLERPLANE TRANSPORT DESIGN STUDY



DAXIED PROPELLER VTOL AIRCRAFT DESIGN STUDY



REDFER BECAME even a definite design. Hiller stated the advantages of the tilt wing type against those of the ducted propeller.

Hiller Puts VTOL Hopes on Tilting Wing

Hiller Helicopter is placing its hopes on the gyroflexible, tilting-wing VTOL concept in the industry race to produce a practical vertical-lift transport design.

Hiller's chief technical engineer, Joseph Stuart III, says the principal advantage of the tilting wing is that it reduces thrust requirements during transition from vertical to horizontal flight. When the wing is tilted at an angle of attack, the lift generated by the wing at all air speeds in its angle of attack decreases from 50 degrees across the decrease in thrust requirements.

When the vertical component of propeller thrust has to produce the necessary lift, the thrust requirements are forced to rise sharply during the first part of the transition.

Pitch and Yaw Control

Pitch and yaw control are possible in the Hiller design by controllable tail jets. Propeller wash is expected to carry most jet exhaust gases and prevent these from being recirculated through

engine intakes. Roll control while hovering is provided by differential control of the power settings of the wing-mounted engines.

Landing wing helicopter needs planes can be designed to work out the differential power control and maintain control when the wing approaches normal angles of attack.

Propeller-Lift Advantages

The wing profile which must bear the entire weight of the aircraft is not expected to create any particular difficult engineering problem, Stuart said. He reported that the loads carried by the wing profile are actually much lower than those carried by the main propeller blade attachment bearings.

Stuart said the propeller lifting system was chosen because:

- It allows the lowest possible fuel weight for hovering flight because in the very, actual three to 10 minute stage and is such slightly inferior to rotor system for hovering duration up to a half hour.
- Propellers are collected to be lighter

than rotors in spite of the additional weight of pitch and yaw control jets needed by the propeller system for control in hovering flight at a design weight of 60,000 lb.

Well-developed production and maintenance techniques reduce the probability of unforeseen production and maintenance problems.

Low noise levels can be achieved through the use of inherently low propeller tip speeds.

Overhead takeoffs and landings can be made in conventional runway configuration with a high wing and fuselage-mounted gear.

Stuart said that each of the four dual rotation propellers in the Hiller design is driven by at least two turbine engine power sections. The failure of one power section, therefore, cannot stall the engine, uncontrollable during hovering flight.

Hiller studies and tests of propeller stresses at the thrust level anticipated indicate that vibration levels will be acceptable.

Stuart pointed out that a propeller

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What thing wing transport could be developed immediately using existing gas turbine engines and propellers while other VTOL concepts require extensive powerplant development.

Strait said that other vertical lift powerplant systems considered by Sikorsky included:

- Direct lifting heliports or ducted fan engines
- Ducted propellers powered by turbine engines
- Lifting rotors dropped to be jettied, stopped, retracted or used as propellers in forward flight.

In the gross weight of 50,000 lb used in the study, ducted lifting rotors were found to generate the necessary lift with the least powerplant-plus-lift weight for hovering flight compared to its three concepts.

They were rejected, however, because the high torque specific fuel consumption caused weight disadvantage

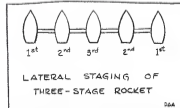
which increased rapidly with time for hovering operations greater than three minutes.

A turbine-driven, ducted propeller lifting system was rejected because duct weight and duct and housing vanes at high speeds, were found to be too great.

Later lifting systems, while great as the duct lift per brake horsepower, ran into difficulties because:

- The numerous mechanical articulations at a rotor hub create a maintenance problem.
- Rotor blades are difficult to tool, fabricate and handle in the field and their critical curved joints are difficult to control and inspect.
- Large, slow turning rotors are the source of unacceptable, difficult-to-use low frequency vibrations.

Effort has also been engaged in a convertible rotor system study for the Air Force.



Lateral Staging Plan Proposed for Rockets

A different approach to the design of a multistage rocket such as an ICBM or an earth satellite has been suggested by two Glenn L. Martin Co. engineers, Darrin M. Cook and L. Van Eppens.

Martin has contracts for both an ICBM (Project Titan) and a earth satellite (Project Vanguard).

The new scheme would use lateral staging, with parallel burning of all stages simultaneously, rather than the traditional staging, zero-burning prior stage, non-ignition associated with each stage rocket.

Cook and Eppens evaluate under thrust and lateral configurations using a performance criterion developed earlier by McNamara and Strassmeyer for multistage rockets. They say all cost investigated show higher performance

with lateral staging than with traditional.

All rocket motors burn simultaneously in the lateral arrangement. During the burning period, fuel is pumped from the outboard tanks to the inner rocket at a rate that keeps all tanks except the outer ones full of fuel. When fuel is exhausted from the outer tanks, they are jettisoned.

This continues until only the outer single rocket is left.

Components of the two rockets are made on the basis that both multistage rockets would have the same payload, structural weight and propellant weight. All the motors of the lateral scheme would be identical with the first-stage motor of the tandem rocket.

Other advantages of the lateral scheme over and include a higher thrust weight ratio, and ignition of all motors before launching.

Cook and Eppens presented their findings at the annual of the American Rocket Society.

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The B. F. Goodrich Co. dynamometer, shown above, automatically simulates the varying take off and landing loads imposed on aircraft tires. Tire loads and wheel speeds are controlled by motor. The 5 ft. dynamometer wheel can duplicate landing speeds up to 180 mph, wheel rotating at 1,000 rpm. Flare wheel and tire are pushed against the dynamometer perpendicularly. A Redfern Load Hamilton SR-4 load cell provides accuracy of five loads on the dynamometer. We choose ten two designs, one each for large and small tires, on opposite sides of wheel.



Pressure Transducers

A new differential pressure transducer which will work, calibrated and tested, differential pressure, differential tension, or thought pressure or suction, has been announced by the Aircraft Products Division, Manning, Macmillan & Moore, Inc.

The new instrument will handle all pressures on differential pressure: from 0-200 psi, or 0-600 psi. Its sensitivity of 0.010 psi remains constant throughout its entire operating range. To make the mechanism rugged it is constructed without springs, bellows, diaphragms or Bourdon tubes.

The instrument provides readings on a 240 in. scale and on a column of accuracy. Address: Skelton Rock Lane, Denbury, Conn.

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GENERAL ELECTRIC



CORE MATERIAL positioned in Chem-Milled skin, small light areas are integral inserts.

involved in the tooling for each individual insert.

By fabricating inserts and aligning integral with the skin, through Chem-Milling, NAA avoids all these problems and is able to extend the use of sand with stainless steel's strength and stiffness to weight benefits. These all start with a sand.

• Tooling costs are slashed, with clean-cutting expense about one eighth that of conventional machining of the inserts.

• Detail part operations are minimized. • Flow time is drastically reduced to meet as many operations with conventional machining and tooling are eliminated with Chem-Milling.

Aviation Housing

A typical example of how NAA inserts are using Chem-Milled integral inserts and edges in sandwich structure is a housing and mounting pedestal for airborne electronic guidance equipment.

Details of the design were outlined for Alexander Weiss & R. W. Spencer and T. P. Frosch, senior staff members in research engineering at the Martin Development Division.

Design called for a high strength, low weight structure to operate at about 1000.

The housing of which the part is one member, was specified to be pressure tight. The part had to provide inserts in areas where high load rises, pressure loads were expected and the attachment of guidance equipment.

In the laboratory of the part, a 1/2 in. MST aluminum plate was needed to produce the desired insert (from) location and configuration. Then Chem-Milled to give a face of .040 in. with tolerances within .001 in.

For the opposite face, conventional

MST 003 sheet stock was selected.

The core was flamed with 4-in. oil and 4000 degrees aluminum foil. The honeycomb was used and called to final thickness in the suspended condition. It was then expanded filled with a thermoplastic epoxy resin and stiffened to a physical panel.

Master Pattern

A master duplicating pattern, locating the corner radii, inserts and edge configuration was made by taking a physical copy from the Chem-Milled skin into which the honeycomb core later would be assembled. This pattern also was



Equipment Tester

High vibration tester is latest addition to North American Aviation's Denver plant manufacturing military. Device can subject test equipment stress to simulated aircraft and results to 4000. Machine has continuous rated load output of 12,500 lb. Operating frequency range is from 1 to 2,000 cps and provision is made for automatic changeover from constant displacement to constant acceleration. Device was developed by MB Mfg. Co., Inc., New Haven, Conn.

positioned on a physical panel.

The physical panel with pattern and core insert were placed on a Keller duplicating machine and the core was expanded to match the Chem-Milled skin. After the welding, the open area was sealed from the core.

Stress and core were depressed and cleaned in accordance with pre-bond techniques.

Bonding of the sandwich components—Chem-Milled skin, other facing sheet and sculptured core—was accomplished with a high-temperature-resistant adhesive on clean tape face. The adhesive was best pressed into the skin cavity due to produce good bonding, not only at the normal facing surfaces, but in the radii as well.

Next, the components were assembled, bugged and stepped under vacuum pressure at 1500 for half hour, followed by 5300 for one hour.

After the cure the panel was mated to final dimensions, drilled and tapped to match the mating holes on the equipment it would carry.

Compared to a conventional design using separate machined inserts, the Chem-Milled prototype showed a saving of 60% in fabrication time for tooling and detail parts.

Greater savings can be effected where master design modifications are required, due to the simplicity of the tooling for Chem-Milled sandwich components.



Rocket De-Icer Sandwich

Super Spacenet during launch on re-entry rocket now shows how it has saved the effects of ice buildup, leading and erosion to improve flight and the increased speed. (Spacenet would be necessary on expensive rockets small enough to be carried routinely by a shorter orbital craft.) Super says that Spacenet is low on weight and high in thermal efficiency, it consists of an electrical insulator having small sandwiched between two coats of open foam. All three coats are flame-retardant. U.S. manufacturing rights are held by Power Generation, Inc., London, N. Y.

NEW MB vibration isolator

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This new and improved MB-5900 mount will be used for P&W's R2800-C engines. Tests prove that it's stronger than all previous mounts used.

New sturdier design also makes maintenance easier. With a steel rather than aluminum stud, it's less susceptible to damage during engine installation. The stud is a separate part—no need to replace the entire housing.

Along with stronger design, the MB-5900 mount saves weight. Only 26.7 pounds per engine set, it weighs less than any other mount for this job.

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...EXCITE... AND ANALYZE VIBRATION

Soviet Avionics, Part I:

Russian Hardware Lags Behind Theory

By Philip J. Klaus

Soviet electronic hardware appears to be lagging behind advances in theory in the fields of computers, automatic controls and components.

The overall appraisal stems from observations made by Dr. W. H. Bradd, engineering manager of Westinghouse Electric Corp.'s Director Systems Dept., which handles the firm's industrial automation systems work.

It assumes the Russians got their best foot forward during a recent two-week tour of Red production and research facilities by a party of three U.S. engineers, including Dr. Bradd.

Here are some of Dr. Bradd's observations:

- **Semi-conductors.** The Russians say they are making progress in obtaining "steady characteristics" in their transistors. This suggests that they are going through the same trouble which plagued U. S. transistor manufacturers: they developed improved manufacturing techniques and switched to domestically sold units several years ago.

- **Digital computers.** The Russian BESM digital computer, which Bradd calls "one of the most important achievements of Soviet technology," appears to be in the same league with present U. S. machines as in production but not up to the most recent computers. The BESM makes very good use of vacuum devices, according to Bradd.

- **Automatic controls.** The Soviets are studying the use of digital control systems and have built an interesting analog type system which uses digital correction for certain types of errors.

- **Magnetic amplifiers.** The Russians appear to be several years behind the U. S. in their design of magnetic amplifiers, according to the visit to the Institute of Automatics and Telemechanics (represent the best the Reds can do). Dr. Bradd says, however, it should be noted that the even the United States design used in research and development laboratories to prove a concept people do not always select the latest or best manufacturing practices.

Speaking of the Institute of Automatics and Telemechanics, Dr. Bradd says: "It is possible that some of the theoretical work going on here may be rather good. (However) it is not yet possible to evaluate a theoretical program when making through a non-technical interpretation. The scientists certainly explain some of the unfamiliar terminology used in Dr. Bradd's trip report."

Dr. Bradd, Dr. A. G. Hall, Research

Director of Bradd's Avionics Corp., and Dr. B. B. Bradd of the Ford Motor Co., made their trip to Russia under private sponsorship, financed by their individual companies. However, Dr. Bradd says, "we are regarded and treated as guests of the Soviet government."

Bradd emphasizes that "there has been an impression placed on our giving out information on what we saw and what we heard."

Purpose of the trip was to study Russian automation techniques. During the two week period, the three men visited



Dr. WELDON H. BRADD, a PhD in physics from the Westinghouse Electric Research Laboratory in 1956. From 1957 through 1960, he specialized in the development of magnetic materials and high temperature alloys. Since 1960, Dr. Bradd has headed groups responsible for the development of new control systems. In his present position as manager of engineering for the Director Systems Dept. Dr. Bradd is responsible for the development of automatic controls, both digital and analog types for industrial and aerospace use.

seven manufacturing plants and five research or development institutes.

During a visit to the Institute of Precision Mechanics and Calculating Technology, Bradd saw the Soviet BESM digital computer (photo, p. 68). It needed for solution of scientific problems the BESM is a three-decade floating decimal point machine which carries five bits of information for constant purposes and random of up to 11 digits. The BESM uses 5,000 tubes.

The Russians claimed that the BESM is "at least twice as fast as the IBM 701 on certain types of operations."

Four Types of Memory

This claim has been countered by International Business Machines Corp., which says the 701 can perform 14,000 calculations per second, compared to only 7,000 for the BESM. Further, IBM says its new 704 can perform 30,000 operations per second.

The Soviet computer utilizes four different types of storage devices:

- Cathode ray tubes for short-term storage during computations.
- Diode matrix memory for storing problem constants.
- Five magnetic drums.
- Four magnetic tapes.

Bradd's description of the BESM's memory devices makes it sound very much like several U. S. computers. "The machine is set up and the man chooses data information from the tapes or drums, reads out a section of the problem and then sends the answers back to the drums or tapes. The next section of the problem is then set up."

BESM Operations

"They seem to have arrived at rather optimum use of their various types of memory," says Bradd.

With rapid access, larger memories with somewhat slower access, and still larger with slower access will "U. S. computers have been using multi-speed memory access for some time."

Bradd reports that the Russians operate the computer 34 hours a day but that about 20% of that time is spent in testing. Another 8% of the time is lost due to machine error as that useful time is about 72% of the total. The Russians estimate that BESM is the equivalent of 12,000 human operations, performing operating decisions.

Of special interest to persons in the



BESM, Russian digital computer (1), resembles U. S. machines and employs four types of memory, including magnetic tape (2) and...



CATHODE RAY TUBE (3), ANALOG COMPUTER (4) are built with vacuum devices and electronic components.

transmission field was the visit to the first unit of Automatics and Telemechanics, under the Soviet Academy of Sciences.

Bradd reported that the Institute's activities are broken down into three general categories:

- **General theoretical problems.** This includes such things as the theory of automatic control, telemechanics, control and telemechanics at a distance, high-speed and low-speed mechanical devices, instrument precision and analog type systems. Analytical work is often incorporated in experimental work for verification.

- **Digital control system theory.** This includes such things as the theory of automatic control and its application to telemechanics and control. Work is done on pneumatic, hydraulic and electronic systems.

- **Automation of industrial processes.** These activities are largely of a consulting nature.

Relay Systems

The Russians apparently make considerable use of relay or control devices in their some systems in place of the more sophisticated pneumatic control obtained from electronic or magnetic amplifiers. As a result this has done considerable work on the theory of relay

and relay logic systems and the signals used in error detecting systems, Bradd reports.

For example, the Russians are studying the advantages and disadvantages of using different pulse frequencies and pulse lengths in computer control systems. Theories on the optimum design of such systems are expected to be made for application to particular systems as the Russians told Dr. Bradd.

In connection with their work on the theory of control systems, the Russians report that they have advanced beyond Boolean-Algebra techniques for working out more general methods of system simplification.

Digital Control Systems

In addition to reporting that they had built digital devices, the Russians said they had built a hybrid system

Soviet Avionics

The article beginning on page 68 is the first of two detailing the state of the Soviet aviation art as reported by first hand observers. The second article will appear next week.

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Planes of Pedigree

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Russians Have Reliability Problems

The U. S. is not alone in its concern over the reliability of electronic equipment. Dr. W. M. Brandt reports that the Russians have set up a reliability laboratory, concerned chiefly with industrial electronics, in their Institute of Technological and Technological.

This laboratory studies the effects of pressure, influence of stress and the reliability of instruments themselves. Brandt reports: "They are a pessimistic this, rather than a 'constant of transmission.' This seems to be a reliability parameter and is probably a sort of correlation coefficient between input and output. They have developed a theory of potential error which is a statistical method of error analysis." Brandt reports.

The Russians, according to Brandt, divide the problem of designing a system of optimum electronic into two parts:
• Choice of suitable codes, methods, etc.
• Use of statistical methods in handling information.

which is basically analog, with a few vital corrections applied to digital systems." Although logic gates are now widely considered indispensable in analog systems, Brandt says that the Russians are still using analog techniques.

The U. S. viziers were shown a magnetic amplifier circuit for a 14-p. audio which used a transformer generator for stabilization, and three stages of amplification in which the first stage was the transformer, the last two magnetic. The last stage was said to have a gain of 10 and a time delay of 0.2 second.

"In another section, they are doing work on analog servo systems using analog differential methods which are checked by experiment," Brandt says. "The transient response methods of Brown and Campbell (U. S. engineers) were mentioned in his conference of quality of wave motion in airplanes and plane characteristics. The third section of error analysis was concerned, based on calculations using the X."

They have worked up a similar method using optical functions."

In a laboratory which Brandt visited, devoted mainly to pneumatic and hydraulic controls, he noted that they have set up an experimental hydraulic system that works on the principle of changing pressure in the power piston rather than by controlling displacement. With this equipment they are able to set up several stages of hydraulic amplification and make various arrangements of feedback."

The Russians are working on magnetic fluxmeter systems with "light channels which capture frequencies and obtain with the channels distributed in time," Brandt was told. "They use a 200-cyc/sec band with a time frequency of 1 to 1 sec. They claim that by this method they are able to see a smaller number of tubes and amplifiers and



FAULT-TYPE data transmission is being investigated by the Russians with the relay shown above, which consists of what appears to be a recording network.

OUT OF THIS WORLD

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TWO-STAGE HYDRAULIC pump assembly was shown to Dr. Brandt by the Russian

that the accuracy achieved is 140%," Brandt says.

Brandt says an analog computer capable of solving such order differential equations, linear and non-linear. At times, run speed of about 5%, not up to U. S. standards. Answers were usually displayed on a cathode ray scope. The computer consisted of a one side about four ft high, containing the controls for solving any straight linear problem (page 9, 69).

Along the machine was another class into which plugs modules, each representing a desired function controlled by diode circuits, was plugged. From its perforator the Russian analog computer does not appear to be as easy to operate as the U. S. counterparts.

The subsequent diodes used in the circuits were the only semiconductor tubes which Brandt saw during his visit, although he observed numerous tubes in use elsewhere. He notes that the analog computer was completely constructed, perhaps too compact, because it appeared to be rather hot.

Brandt concludes that the historic approach to be doing better work in production and maintenance services than they are doing in electrical control systems. He adds that "better work has been done on both types of systems in the machine in long ago as seen in night vision. At some time it should be remembered that some of the most advanced work in the United States has been done in the military field. If this is also true in Russia we would not have had as big problems to solve as it."

Soviet Components

With this qualification in mind, Brandt also observed that "in the field of magnetic amplifiers, there seems to be behind in some cases, assuming that the work we saw here was the best they are able to do."

During a visit to the Kuznetsov Zvezda Factory at Leningrad, under the Ministry of Radio Technology Industries, which produces automatic telephone exchanges, Brandt found that "considerable progress has been made in auto



MECHANICAL, ELECTRICAL, AERONAUTICAL AND CHEMICAL ENGINEERS DRAFTSMEN ENGINEERING DRAWING CHECKERS

Aerjet-General, America's leader in rocket propulsion, announces the selection of its new Liquid Rocket Plant at Sacramento, California. Devoted to research, design, development and manufacture of large liquid-propellant rocket engines, the new plant is the world's largest industrial establishment of its kind.

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For further information please write at once the Personnel Department, Liquid Rocket Plant, Aerjet-General Corp., Sacramento, Calif. Your inquiry will receive immediate, confidential attention.

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meeting the final inspection of these technicians."

Watching the Reds working until each one of a team Dr. Brandt observed that the technicians were comparable to those found in the U.S. prior to World War II.

On the subject of technicians, an old device to previously cited facilities with obtaining "ideals" characteristics, the Russians indicated that work on electron tube transistors is only beginning.

During a visit to the Experimental Scientific Research Institute for Metal Cutting Machine Tools (INMIS) Brandt was told that solid state control machines and control had a lot of about one million volts, but that the life would be much better if they could cost the contacts with silver or gold.

Reds Pay Scientists Well

Papers which Brandt obtained confirm that the Soviets pay their engineers and scientists well, at least by Russian standards. For example, at INMIS engineering salaries ran from 1,400 to 3,500 rubles per month, with top salaries at about 1,000 rubles, except for the chief engineer who earns 4,000 rubles per month. However, bonuses of up to 2,000 rubles per month can raise the engineer's total income per month.

Because efficient international exchange rates can be misleading, it is interesting to evaluate these salaries in terms of the cost of a Russian bicycle, which runs about 600 rubles, according to Brandt. On this basis, the chief engineer at INMIS could buy approximately 10 bicycles with a month's salary and bonus.

Based on the gang U.S. price of bicycles, this would place the chief engineer's salary at around \$400-\$500 per month. It would take about three to four months salary and bonus for the INMIS chief engineer to buy a four-cylinder 50-hp. Polaris motorcycle.

If this seems rather modest pay for a top engineer by U.S. standards, it should be remembered that an average worker in the St. Petersburg tractor plant earns only about \$100-\$150 per month. Engineers at the same factory start at the same figure but can move up to as high as 2,100 rubles per month, Brandt was told.

Average salaries of the 450 engineers employed at the Institute of Precision Mechanics and Calculating Technology is about 1,500 rubles per month, Brandt learned. The director of this and other research institutes is nearly always a member of the Academy of Sciences. Russia's top scientific body. Such an academician gets a month's salary of 3,000 rubles just for being a member of the Academy, plus another salary as director of his particular institute.

FILTER CENTER

► **Thermostat "Breakthrough"**—Another new thermostat, called the "green oil" type, reportedly can operate at control power levels as low as 100 mva and operate at 250 mva. The new technique was developed by Texas Instruments which says it already is producing the new type units. One silicon transistor products a gain of 15 db at 12.5 mva, and 14 db at 10 mva, with control power levels. A germanium-based germanium unit, now in production, gives a 10 db maximum gain at 100 mva with collector dissipation at 25 mva at 74C. Cutoff frequency is 280 mva.

► **New Tech**—In the industry's gold rush to recruit new engineers at least one company, Sperry Rand Corp., has not forgotten to honor its "old timers." The Sperry Engineering Review, which comes out every other month, directs a number of articles to biographical sketches of engineers who have completed 15 years service with the company.

► **Successful Marriage**—National Bureau of Standards reports that it has welded the SPAC and the newer DVSAC high-speed digital computers to cover aircraft work out a data processing task. The problem simulated a situation in which track transaction reports were collected and summarized for passing to mission control records located at some remote site. SPAC tabulated and summarized the track transaction in words, then translated DVSAC and transferred the data to the latter for



Tough Customer

General at a remote site for the General Electric Instrumentation Corp., working in a photograph was recording data of the time a Navy jet fighter hit the ground, and was forced to make an additional 75 feet of record before the division of its power supply. Record the current and after record processing produced desired data. CEC says. Despite crash impact CEC says it found the unit's instrumentation to be in perfect operating condition. The recorder was repaired, recalibrated, and returned to service.

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Aerial Applicators Defy Crop Planners

By Edwin J. Hallas

College Station, Tex.-U. S. aerial application are rapidly gaining a foothold in their "target market" against the farmers' natural enemies. These predators, in fact, has studied the point where it threatens to frustrate the best-laid efforts of government planners to control agricultural production.

These depots of efficiency were made unmistakably clear in a report to a 1994 government study taking a million acres of cotton out of production in Texas. Despite this, 19% loss acreage, aerial application are credited with enabling the state's farmers to grow the same amount of cotton last year as in the previous period.

The applicator's skills are constantly being absorbed through an ever-increasing number of conferences at top-notch agricultural colleges such as the Texas Agricultural & Mechanical College System here where scientists find them on research being done in insects and other pests, diseases and their application and methodology.

More than 100 applicators, operators and three attended the 8th annual Agricultural Aviation Conference held here recently at Texas A & M. The conference was sponsored by the

College System, the Texas Aeronautics Commission, Texas Tech University & Southern Area and the Texas Aerial Application Association.

Industry Critique

In a front critique of the industry, John I. Nease, manager of the Marsh Aviation Co., Plaquemine, Ala., and vice president agricultural activities of the National Aviation Trades Assn., told delegates:

We carry the war to the common-sense exception we put a plane load of chemicals into the air. We do that because we're providing close support to the farmer in his best production battle—a battle in which 75% of American cottons level off in this country and a good part of the rest of the world, while in Russia it takes 64% of the people to feed that nation—and a lot of them are hungry."

Despite the job they are doing, Nease warned the applicators, the great public thinks of them as "expensive delinquents" about drug, desert delinquents... yet one safety record last year was better than that of the U. S. Navy and Marine Corps combined."

Strongly critical of government criticism, Nease said that there are 750

potential customers for every U. S. agricultural airplane. He noted that there are about 2,800 aerial applicators, old and new, in business in the U. S. today. In the past, however, high unemployment has resulted in 12% of the total number of young men having to devote themselves to flying.

Aerial applicator expenses were broken down this way by Nease: 45 cents of each dollar for revenue, 27 cents for taxes, 10 cents on equipment and 13 cents for engine consumption, leaving a small profit for the operator.

Chemical Application

One of the major problems faced by aerial applicators is how to distribute material evenly in the face of crosswinds, disturbances caused by airflow along the airplane, propeller slipstream and wingtip vortices.

Thus, a constant re-evaluation by the applicator and agricultural research workers on dropping equipment, the best location of nozzles, spray patterns and control units to solve the problems suggested by research made by members of the Texas A & M conference included:

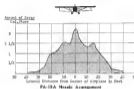
• **Spray equipment** that would produce all drops with diameters larger than 100 microns was recommended for use with herbicides by Richard Behrens, U. S. Department of Agriculture. Drops should be numbered at approximately 70 at some per space such to give effective results. When Diesel oil is used as a carrier, low volume applications are necessary to avoid rapid leaf fall which may reduce the effectiveness of the herbicide.

Past recommendations have suggested that the largest drops are possible should be used in aerial applications of herbicides because, tests indicate that smaller droplets of the same amount would be more effective, per particle when using 3.4-4.5 ft.

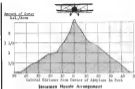
• **Nozzle** for uniform droplet size was confirmed by George A. Roth of Texas A & M's Aerial Research Center. Roth said a spray composed of surface droplets would provide more perfectable and even distribution patterns than could be accomplished by other nozzles.

Roth also confirmed some recent tests with nozzle arrangements for Piper PA-35A Super Cub and Stearman biplane aircraft which he said should provide more uniform distribution patterns than with more recently used arrangements (see diagram p. 83).

He detailed tests made by the Research Center that included a range of



Conditions:	Nozzle Location (Distance from Center of Airplane)	
	Left Wing	Right Wing
General - Main Zone	0'-0"	0'-0"
Ground Spraying - 40 ft.	4'-0"	1'-0"
Aluminum - 40 ft.	4'-0"	7'-0"
Herbicide - 40 ft.	3'-0"	4'-0"
Herbicide - 40 ft. (normal)	4'-0"	6'-0"
Quantity of Application - 5 gal./acre	6'-0"	7'-0"
Rate of Flow - 100 gal./min	6'-0"	8'-0"
Nozzle - 23 Spraying Systems Co. 23-45	10'-0"	0'-0"
Spray Pressure - 10 psi.	13'-0"	0'-0"
Spray Fluid - Water	14'-0"	12'-0"
Airplane Dia. Diameter - 200 inches	14'-0"	14'-0"



Conditions:	Nozzle Location (Distance from Center of Airplane)	
	Left Wing	Right Wing
General - Main Zone	0'-0"	0'-0"
Ground Spraying - 40 ft.	0'-0"	0'-0"
Aluminum - 40 ft.	0'-0"	0'-0"
Herbicide - 40 ft. (normal)	0'-0"	0'-0"
Quantity of Application - 5 gal./acre	0'-0"	0'-0"
Rate of Flow - 100 gal./min	0'-0"	0'-0"
Nozzle - 23 Spraying Systems Co. 23-45	0'-0"	0'-0"
Spray Pressure - 10 psi.	0'-0"	0'-0"
Spray Fluid - Water	0'-0"	0'-0"
Airplane Dia. Diameter - 200 inches	0'-0"	0'-0"

**"Less 10" below normal beam location



TESTING INDUSTRY INTEREST is developing new aircraft to replace current obsolete types as Piper PA-35/Week Ag 3 tested which is providing ideas for light aircraft.

centimeters of up to eight miles per hour, providing data that showed radical changes in the topological system of distribution which had provided satisfactory coverage with cross currents of less than one quarter mile per hour and a 50 ft. swath spacing.

An increase in crosswind resulted in a definite and progressive change in swath pattern, changing from a nearly even-spread and uniform spread to one which was asymmetric and with a pronounced hollow near the center. Even at intervals of only two miles per hour, crosswind caused distribution to be very irregular. These were points of deposit 60% below average as well as some 50% above.

Swath spacing was reduced to 60 ft. and distribution was improved so that variance from the average at swath center was 50% compared with 45% for the 50 ft. spacing. Varying the wheel height above the ground made clear the probable failure of such tactics with a downward of over one-half mile-per-hour the pattern became square with sharp edges and very concentration on the spread side and a definite hollow and cross concentration in the center.

Tests of water effects with a Bell helicopter showed that a violent wave was produced at a low speed of 15 mph and that, contrary to popular belief, it acted on currents at the end of the



LATEST PAPER/WATER to work the field in weather is the new Collet, one flying at typical operational altitude. Cockpit is offset to the left; chemical hopper is on right.



BACKLOGS of agricultural plane fleet still in large fleet of mostly modified Stearman copies. World War II biplanes approached by more modern types of PA-W II vintage.

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your home an outdoor and up in the air, using wing aircraft produces a feeling similar to a fixed wing aircraft. Strength of the various and dimensions was naturally selected at a speed of 15 mph. Experimenters, Wiley Yates and Norman Ahern, University of California, recommended for maximum drift with headwind speeds. Fly low, keep the altitude at least three feet from the winging, keep the beam as far down from the wing as a pole test.

Granular Chemicals

The probability of obtaining more mass with distribution of granular type chemicals by using a semi-conventional dust distributor with discharge no more than six feet either side of center was brought out by F. G. Chubbuck and V. D. Young, Department of Agronomy, Forest Grove, Ore.

Tests were conducted with a Stearns engine operated by Jack Mulvey, local operator of Kansas Falls, Ore., having a conventional dust distributor with an overall spread of 5 ft. Observed effective width was close to 30 ft. at a 10 ft. height level. This width could be further extended to about 35 ft. by having a six-inch vertical opening along the lower lip of the distributor and bending 15 to 2 inches of this down ward at about 30 deg. to form a spout.

An experimental 200 rpm spreader was tried that provided a width of approximately 50 ft. at the rate of 50 lb. to acre on an altitude of 10 ft. However, the flat plate area and parallel drag provided by the driver induced accept from 50 to 75 mph—considered unsafe dispersion. The experimenters plan to continue experiments with wide spreaders with aerial characteristics to reduce this drag and yet provide adequate vertical velocity necessary for wide distribution.

Metereology Aid

A simple, yet effective method of measuring weather conditions at a particular site was demonstrated in the class of the conference by Dr. M. H. Holsted, agricultural meteorologist at Texas A & M.

Called a "smoke puff," the instrument comprises a Model T spark coil, a switch battery and a spark plug, is small enough to go into a car's glove compartment. A barometer (5 grams) of air (Type PFF) is used for each puff. Basically, the device acts in the principle that the rate at which the smoke puff disperses is a function of the turbulent mixing of air at low levels and by measuring the time for which the puff remains visible, turbulence values can be determined.

The principle of using turbulent mixing in this meteorological aid was de-

veloped on the basis of studies on the spread of smoke and gases for USAF. It was noted that the spread of smoke did not depend on wind velocity alone, but included an important factor known as turbulent mixing. This factor is responsible for smoke being carried aloft on a hot day even with light winds. This pattern of turbulent mixing is determined not only by the wind but also by temperature distribution near the ground.

For example, when turbulent mixing is high, the puff remains visible for about 12 or 15 seconds, when it is low, it is visible for as much as 60 sec. By trial and error, the optimum factor for various types of applications can be checked, using a stopwatch to keep track of the smoke puff.

For example in an operation that involved an outbreak of downy mildew, spraying during procedure aimed at fungi, and recommending that the chemical smoke and smoke on the underside of the plant's leaves, a smoke puff distribution time of 20-25 seconds was found to indicate optimum conditions. When the procedure was aimed at attacking insects, a dispersion time of about 30 sec. was found the best.

Single in the method tested, it has saved one large operator some \$30,000 a year in increased efficiency.

Pan-Am Southern Gets Lightweight Lodestar

Hundreds of pounds were shaved off Lockheed Lodestar engine compartment converted by Executive Aircraft Service, Inc., Dallas, Tex., for Pan-Am Southern Corp., New Orleans by using lightweight materials and releasing equipment.

The conversion center provided an airplane weighing 13,350 lb. empty with a useful load of 6,120 lb. Powered by Wright R1820-71 engines, developing 1,275 hp, an installed and 550-hp each, covering the Lodestar between 215 mph cruise speed on the latter power setting. Cliff Conrad, Pan-Am Southern's pilot sports Standard loadings at 4000 psi. At an average of 85 mph, range is a little over seven hours.

Important weight savings were made by locating all engine equipment between the wing spars, grouping the equipment in this area increased wing length, cutting about 220 lb. over standard layout. Additional savings were realized by eliminating the exhaust pipe harness and installing a harness unit in the No. 2 baggage compartment. About 200 lb. were also saved by extensive use of Formica-surfaced bulkhead for interior furnishings. The next section was left as far as possible for future installation of radio and additional avionics equipment.

BASIC LOADS

Engineers with training and experience in this field will be interested in new developments at Lockheed Missile Systems Division.

New positions have been created for:

- Basic Load Engineers
- Structures Engineers
- Aerodynamic Engineers
- Dynamics Engineers

to work on basic loads caused by high performance configurations, specialized missile system criteria, airway recovery positions and new environmental conditions associated with many types of advanced missile design.

The positions require an M.S. Degree in Mechanical, Aeronautical or related fields of engineering and at least two years' experience in loads, dynamics or aerodynamics, including transient or supersonic aerodynamics. Equivalent experience will be considered.

Because of planned expansion in this department, the positions offer unusually favorable opportunity for promotion to supervisory level.

Those possessing a high order of ability applicable to this field are invited to write

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research and engineering staff

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North American's Columbus Division has prime responsibility for the design, development and production of North American's Naval airplanes. The Division is young, with the highly successful P-4, a "concept to flight" Columbus Division product, as evidence that its engineering team is "going places."

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For The Full Story On Your Own Future, Write Today: Mr. J. H. Papp, Personnel Manager, Department MAW, North American's Columbus Division, Columbus 18, Ohio.

Ercoupe Rejoins Private-Plane Field

Production of an improved version of the two-place spinproof Ercoupe private plane has been ordered after a six-year lapse.

First deliveries of the Ercoupe, as it is now called, are scheduled to begin within 60 days from Piper Aircraft Company's Austin, Ontario. The first Ercoupe was rolled out in mid-December. Sixty more are to be in the production line.

Price of the new model is estimated at \$5,000. The Ercoupe is powered by a 90-hp Continental engine turning an all-metal McCauley propeller. Flight tests show that the airplane has a top speed of 120 mph and a range of 700 mi. Tailwheel landing gear of the old Ercoupe has been replaced with main. Piper is building its own VII vital instrument and recovery equipment, so be satisfied in the glove case pocket area.

PRIVATE LINES

Passenger transport version of the Lockheed T-28 supersonic airplane remains the proven in addition to the pilot in space usually occupied by the observer's logbook. If the seats are removed, up to 1,500 lb. of cargo can be carried.

An Alaskan aeromedical chart, consolidating the reports of Baranofsky, Alaska and Chitwanetsky aeromedical, is being prepared by the Alaska Department of Aeromedical, Montgomery. To appear in an atlas, it will be in World Aeromedical Chart book.

Annual spring seminar for corporate pilots will be held Apr. 20-21 at the University Club, N. Y. C., by Executive Air Transport Co., Inc., 900 Box 175, Scarborough, N. Y. Subjects will include: emergency airborne safety, traffic control, instrument flight and procedures. Cost per person is \$80.

Aerial survey covering 215,000 acres along the Congo River has been awarded Photographic Survey Corp., Toronto, Canada, by Venezuela. Another area box of El Estero, Venezuela, Ltd., Aerographic Survey, Ltd., has opened a new research and development laboratory at Oshana Airport, near Toronto for new airborne photography equipment.

Ontario Paper Co., Thornhill, Ont., has purchased a Rembrandt-Warner-co. rolled Douglas DC-3 with PW-7 Super 92 engines for use as a spare parts engine and testbed.

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Circle 15, Page 106

COLUMBUS DIVISION



DC-3-1935



DC-4-1938



A-20 Aircraft-1935

B-12 Flying Laboratory
1941

A-26 Aircraft-1942



B-24 Aircraft-1944

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DC-7-1947

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1-33-1125-1121, 1-31-100-1811
1-31-1125-1121, 1-31-100-1811

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Turbocompound ASC-1 jet and turbo-prop engine starter provides 210 lb./min. weight flow of air at 60 psi, and is suited to exceed the requirements for the Allison J71 and Pratt & Whitney J34-71 powerplants. Engine starts made on the J71 in less than one minute with the unit. It is an incompressible Genset, Inc., 3515 N. Sylvia, Ft. Worth, Tex.



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A new line of hysteresis synchronism motors available in 8,000, 12,000, or 24,000-rpm speeds is admirably for single, two or three-phase supply with variable plating operation in the output.

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Centrifugally-mounted dual-element lube pump for gas turbine engines is built for use with petroleum-based liquid oil or jet lubricating oil MIL-L-7846. Its capacity is 5 gpm at 30 psi gage and 1,600 rpm. Rated capacity is based on pumping SAE 10 lubricating oil at 275 F. Nominal input is 0.75 hp.

Power elements are water or shaft seal, O-rings or packings. Service is based on 1,000 hr at trouble-free operation.

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Valve for Missile Launching

Electrostatic, two-position, solenoid-controlled hydraulic valve for use in missile launcher system operates on 90- to 175-v, 60-cycle single-phase a.c. Equipped with moisture-proof housing, it can be left continuously energized in 165F ambient temperature. Shaded poles reduce a.c. burn.

Valve has no separating components and will not respond to high-



impact shock. It has passed the MIL-8-93 RT shock test.

Unit operates in -20F to 165F in 5,000 to 1,000-psi hydraulic system. Capacity is 1.5 gpm at 100 psi total pressure drop. Maximum total control leakage is 1 in./min at 1,500 psi.

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Artos TA-26-S
with guard raised



Some samples of terminal attached by Artos machine

This new Artos TA-26-S brings still greater speed and production economy to large-quantity users of wire leads with terminals attached. It automatically performs the following services *all in one operation*—

1. Measures and cuts wire to predetermined lengths.
2. Strips one or both ends of wire.
3. Attaches permanently strip preformed terminals in strip form, to one end of wire.
4. Makes finished wire leads with code numbers and letters. (Optional attachment not standard part of machine.)

ALL OPERATIONS ARE AUTOMATIC. Machine can be operated by unskilled labor. It is easily set up and adjusted for different lengths of wire and stripping. One user for different type terminals simply and quickly changed. Production speeds up to 3,000 finished pieces per hour.

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Artos 405 on the
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electrical switches and two probes, one for high and one for low pressure sensors. Single switches in units, the pressure switches in the Model RA 1913D-A so that the set can be checked as the ground for leakage.

Leak-Romex Division, Kent, Inc.,
Ft. Collins, Ohio



Tiny Blower Gives 60 Gfm

Arcolflow blower, using stainless steel, has a 2 1/2 in. diameter body 3-in. long and produces 60 cfm. of free air. Jetifier design incorporates a mass separator to exhaust water and remove carbon. Units are available with and without filters.

Mechatronics Corp., 248 Cooness Rd.,
Cleveland, Ohio

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Glass run, with Teflon coating for smooth flow, for aircraft, for aircraft cables in wet to aircraft and corrosion chemicals. Nominal quantity less a 1250—L. O. F. Glass Fibers Co., 1810 Madison Ave., Toledo 1, Ohio

Radiometer RM-95 (push-type detector), simple gamma-radiation detector, will monitor up to 600 readings of gamma radiation. Easy-to-read scale so only total indication to which a body has been exposed even in a given period of time. Device can be stored indefinitely.—Brendon Analytic Corp., Cassinville Division, 201 W. Third St., Cassinville, Ohio

Polyester glass insulating (Fiberglas) conductive coatings are available for all conductive surfaces in aircraft for filling structural cracks. It can be used to a low density finish which can be used up to 512°F. Properties of the material at 70 lb./sq. ft. density—Dichromatic

Electronic Gl. Insulating plastic powder is designed for filling structural cracks. It can be used to a low density finish which can be used up to 512°F. Properties of the material at 70 lb./sq. ft. density—Dichromatic



at 12" cfm, 1 1/4, dissipates faster at 10" cfm, 6000, impedance strength, 600 ps—Electro-Clean Inc., 9030 Bellvue Ave., Los Angeles 45, Calif.

Compact aircraft vacuum cleaner is designed to pick up debris and non-metallic metal chips and debris up to 1 in. diameter. Unit operates on 98 lb. or pressure—Aircraft Tools, Inc., 9030 Bellvue Ave., Los Angeles 45, Calif.

Automatic reworking machine automatically attaches ring nuts to metal tags at the rate of 75 per minute while measuring, grinding and variable data—Dobson Instrument Machines, Inc., 5565 Stanley Blvd., Culver City, Calif.

Completely synthetic base, used in making jet engines heated, blades are continuously at temperatures to 400° and working pressures of 180 psi. It can be applied with oxide dissolution from 5-in. to five inches and lengths up to 50 ft.—Quaker Builders Div., 31 E. Peter St., Inc., Philadelphia, Pa.

PHI multi probe, for aircraft manufacturing, bonding, welding and drawing of low-temperature and other new materials, for making area of 5x10 in. and total pressure of 950 lbs. PSI has automatic opening of 15 in.—Pneumatic Tools, Inc., 779 N. Hill Ave., Pasadena 4, Calif.



JET BLAST DEFLECTOR developed by Boeing has been tested only in Boeing's Manufacturing Co., Inc., Chicago, Ill., is customer known. Unit has been tested for about 90 days, upgrade to protect ground and property behind jet aircraft being run up on the ground.

Four-digit digital voltmeter automatically measures a.c. and d.c. voltages with an accuracy of 0.1% of full scale and ± 1 digit respectively. Range to 0.001 to 999.9 volts. Frequency response in from 30,16,000 cycles at 10 megahertz, 20 micro-ohms. Unit is designed for measuring in a standard 19-in. rack—Electronic Instruments, Inc., 1704 Rosemont St., San Diego 16, Calif.

Magnetic alloy additons, called Magnalloy, are applied with d.c. welder wire feeder and magnetic hopper combination. They are deposited at 20 to 70 lb. Magnalloy HIF 70 has hardness ranging from Rc40 to Rc55, HRF40

range from Rc45 to Rc55, W18 range from Rc20 to Rc55, B11 from Rc30 to Rc55—Western Carbide Corp., 6940 Viewland Ave., New Hollywood, Calif.

Multi-synchronous, data recording Syn-Cassette provides automatic, method-frame analysis, photograph notation taking place simultaneously at separated locations. Control system eliminates the need for mechanical conversion from camera to camera. Available in 16 mm and 35 mm—Flight Research, Inc., Richmond, Va.

Self-locking fastener attaches wire handles, plumbing lines, machine blankets,

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FLIGHTCOM PACKAGE

Model 400-12/24

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Typical of the advanced research and development projects currently being carried out successfully by Kansas Aircraft is the drive heliograph. The industrial use of a remote control air line equipped with a computer there with the driving aircraft known as the "open a sky" is by a very direct line of sight, or radio, as well as in Kansas in fact. Kansas Aircraft recently solved these complicated problems by designing an entirely new electronic control system, subcarrier mechanical system and small automatic pilot. Kansas is proud that most of its 18 years have been devoted to the National Aerospace effort to keep the face world face.

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brake ducts, actuators etc. Made under license w/ Boeing Aerospace Co, now it used on EC 119 jet trailer. Two types: a) for single-ended mounting, extrusion form for double ended mounting—Western Sta. Industries, P.O. Box 200, Hayward, Calif.

Portable cable testers can handle both standard formats such as AN 568 up to 50-in. cable size and derivative for users through 8 in. Total weight about



12 lb. and operates on 50 lb. of air pressure—Aerotech Tools, Inc., 9030 Bellows Ave., Los Angeles 45, Calif.

Miniature power-type voltage sources are designed to replace chemical cells and VRL tubes. Low voltage variations are $\pm 1.1\%$. Units measure 3.5x3.5x1.0 in. They draw 25 μ a from a 480-cycle source and are available in output voltages up to 20 v d.c. and in output currents up to 1,000 ma.—Tish, Instruments & Controls Corp., 1645 W 131st St., Gardena, Calif.

DPE, seal-and-panel type connector is made up of 40 contacts and is narrow for crowded installations. Plasterable is rated at 1,700 v., 60 cps., a.c. rms at sea level. Weight of the mated connector is 0.781 lb. Complete assembly: DPE-40 34P for the plug with pins and DPE-40 51S for the mating socket only—Cannon Electric Co., 1399 Hawthold St., Los Angeles 31, Calif.

V-lock vibration-resistant Tonnets incorporate V-type notch with conical rim of the barrel compressed evenly against the axle, to form a permanent seal. It is a one piece, self contained unit, may also be used as a stop nut.—Car Products Co., Division of United Car Furniture Corp., Cambridge 42, Mass.

Series D pressure force indicators have capacities of 50, 75, 100, 150 and 200 lb, capable of measuring all forces up to their maximum capacities with accuracies of 1 lb for 50 lb model, 1 lb for 75 and 100 lb models, 1 lb for 150 and 200 lb models. Individually calibrated, direct-reading dials have 100 divisions—Engineering Dept., Hunter-Sanner Co., Lumbold, Pa.

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Pharmaceutical Market Reform: Systems and Institutions in Taiwan's Case


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WHAT'S NEW

Telling the Market

Summary of an experiment determining convective heat transfer on a supersonic airframe through use of a V.I. solder as light. Bulletin 13805 General Electric Co. Special Defense Properties Department, 5900 Campbell Ave., Schenectady 6, N. Y. Twelve types of batteries for all instruments of military and civil aircraft, catalog, catalog Form 5771, parallel for solder connections. Electric Storage Batteries Co., Box 5105 Philadelphia 1 Pa.

Results: low-stage fuel flow meters for light twin-engine planes, illustrated brochure. Aero Oil Corp., Mobilite N.J. Liquidometer capacitor-type fuel gaging system. Bulletin 346, Liquidometer Corp., Dept. 5 Hoffman Ave. & 10th St., Long Island City 1, N.Y.

Electrolytic shaping of honeycomb structures to produce clean, sharp cell edges for optimum skin bonding. Bulletin 158. Anson Engineering Co., 631 W. Washington St. Chicago 6, Ill.

Model 500 Hi-mag high-speed motion picture camera for research and test in roving catalog. Trul Corp., Sherman Oaks, Calif. Unusually two-piece

Figure 2. Second as

congratulations from the president upon an
 earth! So at least you're on the map, greeting
 the troops in the park of other Great Ladies of the
 Resistance: MARY ELLEN BOWEN, Hayes, and Maryanne
 Boushara too, honey, an opening night just forget
 yourself completely, search out your courage,
 and let the chamber you perform come
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kind of house for my old parents.
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beautiful old house—which reminds
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the place with all those great things—
inspiring that later house—was this
little old house. It's a great

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implementing paths. They'll send
you to any place or corner or square. And
I'll have 'em tell you to go just far from
each other and remember always and always
ways in the chamber, too. Help me
keep things over the top. Some of the
the children. But we don't mention him

Results

Daddy

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AVIATION WEEK April 8, 2008

permeating units for pens and pressurized sprays, coating. Punch Products Corp., 1000 Highland Ave., Niagara Falls, N. Y. . . Background information on titanium and company production facilities, in the State of Tennessee, Mafco Shown Titanium Corp., Niles, Ohio.

Availability and cost of aircraft and crew for flight testing new aviation products, brochures, Equipment Flight Test Division, Meteor Air Transport, Teterboro Airport, Teterboro, N. J. . . .
A design for non-sustaining plug and wing gaps and location, Bulletin 413, price 45 cents, University of Illinois Engineering Experiment Station, Urbana, Ill.

Facilities for producing AN and special base and cable assemblies in addition to hardware machining to specification are described in publications available from Darshan Aircraft Service, Inc., 56-15 Northern Boulevard, Woodside 77, N. Y. Air Sea Survival Equipment, 36 page catalog and instruction manual, write on letterhead to South Polestar Co., 1325 E. State St., Trenton, N. J. Explosive valve line, Catalog 560 XV, Coors Corp., Explosive Products Division, Buffalo 11, N. Y.

Publications Received

* General Billy Mitchell, Champion of Air Defense—by Roger Burlingame—Pub. by Signet Books, New American Library, 301 Madison Ave., New York 17, N. Y., 30 plates (reprint of original hardcover edition pub. by McGraw-Hill Book Co.).

A biography of General Mitchell

**Man and the Whale*—by E. Aubert de la Rue, translated by Madge E. Thompson—Pub. by Philosophical Library, 15 E. 40th Street, New York 16, N. Y. 32 pages \$5.00

The work as they affect different spheres of human activity. Includes one chapter on "The Wind and Southern".

* Aircraft Badges and Markings—by Harold B. Peters, with a foreword by Lord Douglas of Kintyre—Pub. by John de Graff, Inc., 50 W. 23rd St., New York 10, N. Y. \$3.50.

A pocket-sized book, containing colored reproductions of numerous rock-eggs, is faster, and would save time and labor.

*Solid Propellant Rockets, an Introductory Handbook—by Alfred J. Zachary, Jr. 8 1/2 x 11 in. and available only through American Rocket Co., Box 1117, Woodville, Mich.

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The Role of Modern Test Facilities in the Design of Aircraft Gear Drives

by John Morris

Manager of Engineering, Western Gear Corporation

Modern aircraft, whether it be piloted or electronically guided, requires mechanical devices of utmost reliability. No longer can the designer depend entirely upon experience but must have available extensive equipment capable of producing the environments and loading conditions which will check the newly designed parts to the conditions encountered in its assigned mission.

This environmental test equipment must be operated by experienced personnel under the guidance of engineers capable of correlating and analyzing test results and their actual relation to final installation before a suitable product can be designed, produced, and proven. Mother Nature in her unlimited weather laboratory produces extreme variations of the elements in almost uncalculable combinations. The laboratory must endeavor to precisely duplicate conditions. Altitude chambers at Western Gear Corporation (as shown in photo at lower right) can carry the test part to the extremes of altitude beyond the reaches of piloted flight up to and in excess of 10,000 ft. Temperature must be duplicated far below those normally encountered by present day aircraft craft. Tests have been run at Western Gear as low as -300° F.

The salt spray of the sea and the stinging humidity of the jungle as well as the wind and dust of the desert are being duplicated daily in our black-box test laboratory. The tremendous speeds as well as the



severity for the element in control produce forces in any direction which are simulated in Western Gear test rigs in excess of 100 times the normal weight of the part. Studies of the reaction to shock loadings are duplicated in our laboratory by impact tests often running in excess of 300 G's.

The effects of wind, sand, dust, rain, moisture, snow, heat, cold, vibration, impact, chemicals, lubricants and materials must be evaluated while constantly striving to increase load carrying ability, serviceability and reliability of products. Extensive testing is required to assure that no possible condition has been overlooked which may cause a malfunction. An example of a test stand setup to check the operational characteristics for testing lever retention is shown at upper left. The interrelation of magnetism, electricity, gravity, vibrations, forces, materials and chemicals under environmental conditions often poses the necessity of techniques of carefully controlled, precisely measured tests.

Western Gear engineering recognizes these very necessary elements. Therefore, in our black-box testing laboratory the most modern equipment is provided to prove design concepts. This mechanical attention to perfection has made Western Gear the leader in the field of aircraft power and system design. Why not let us assist you in your next power transmission problem? Western Gear Corporation, General Office, P.O. Box 182, Lynwood, California.

Convair Jet Has Transcontinental Potential

By Richard Sawyer

San Diego, Calif.—Convair's new design Model 440 jet transport, the Skylark 400, will have a guaranteed maximum landing roll of 5,000 ft and, as an unplanned bonus feature, will be capable of nonstop flights between New York and Los Angeles.

Convair has not yet received a written Air Force permission to use the General Electric JT9 turbojet engine, four of which power the 550 mph cruise-speed Skylark, but a verbal approval has been given by USAF officials for the Skylark. The JT9 will have 15,000 lb dry static thrust. (See earlier Convair jet design, see AW Aug. 22, p. 37.)

Other details of the Skylark, which has named the airline parent new equipment picture into a landscape of uncertainty.

• A 2,000-sq-ft wing area, base of the

new transport's landing roll guarantee. • Landing roll guarantee does not include use of thrust reversers or boundary layer control.

Although lifted at a maximum range (15,000-20,000 mi), transport the size of the Skylark's low wing could still cost fuel savings space for the east-west transcontinental flight.

• Wing loading will be 70 to 80 lb per sq ft.

• Breakover distance is said to be 300 m but probably will be nearer 250 m after final design changes.

• Breakover load factor (passenger, mail, cargo) will be 65% of aircraft's capacity.

• Takeoff distance (to clear a 30-ft object) will be 6,700 ft at maximum gross takeoff weight of 750,000 lb for transcontinental morning flights. No distance flight gross takeoff weight is predicted at about 157,000 lb.

• Landing roll time at 1,000 ft could just the 1,750 m point since takeoff is at maximum gross weight.

Higher Has First Choice

Douglas Skylark is understood to have first choice at the Skylark 400. The transport has not yet been presented to airlines which already have ordered turboprops.

United Air Lines said it is interested in the medium-range transport as a Delta Air Lines and Eastern (though the latter already has ordered turbo-prop Lockheed Electra) (AW Oct. 3, p. 45).

Delaware of the 55.5 million each plane will start in 1965. The aircraft will carry 50 first class or 99 coach passengers and a crew that will consist of two pilots, flight engineer and two stewards.

Wing span will be 115 ft 4 in.; length 115 ft 5 in. The top of the vertical stabilizer will be 35 ft 2 in. above the ground. Tail and aft passenger entrances will be provided.

The landing gear will have two wheels on the main gear and four on each main strut. The latter will fully retract into the wing's core thick root.

Douglas, Boeing Follow Suit

News of the Convair jet was filled of doubt by proposals of similar planes by Boeing, Douglas and Lockheed. But these were built around the Pratt & Whitney JT9 engine. None of the three announced any details of their proposed planes.

Other aspects of the Convair's appearance in the jet picture:

• Airlines that have ordered 440-sq-ft turboprops for 1960 wanted about 1960. They may want where they competition will be operating Convair jets.

• The unexpected bonus of transcontinental capability jet induces that have not bought Douglas as Boeing into the position of being able to buy transcontinental jets, either made for short and medium range operations and out of present airports.

• The 5,000-ft guaranteed landing roll intended jet service for more cities without their having to spend large sums to expand airport runways.

• The Convair will be able to operate on more European routes where airports cannot be expanded to accommodate the longer landing roll of Douglas and Boeing jets.

• If Convair adds thrust reversers and boundary layer control, the plane's even greater capability will again up at the transport applicant.



SKYLARK THREE-VIEW shows standard jet transport configuration with swept engines.

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Airlines Report Big Increases In Traffic, Revenues for 1955

Airline annual reports for 1955 show substantial increases in traffic and revenues and impressive gains in income. Reports from Eastern Air Lines, Trans World Airlines, Western Air Lines, Northeast Airlines, North Central Airlines and Seaboard and Western Airlines show that all but TWA had a substantial increase in net income for the year.

Eastern Air Lines

Eastern's revenues totaled \$201,353,075 last year, compared with \$189,903,165 in 1954. Net income was \$15,507,467, nearly double the 1954 figure of \$7,112,812. The 1955 income includes a profit of \$3,342,781 from the sale of old equipment.

During the year, Eastern carried 6,753,218 passengers, 5,695,517,469 passenger miles, load factor was 63.65%. In 1954, the airline carried 5,755,998 passengers and flew 5,142,855,651 passenger miles with a load factor computed at 57.97%.

Freight carried totaled 50,018,706 pounds in 1955, and 51,050,485 pounds of mail were flown last year.

Trans World Airlines

TWA carried 4,048,592 passengers last year compared with 3,994,600 in the previous year. Passenger miles totaled 3,542,910,400 in 1955 and 3,212,678,600 in 1954.

Freight and express tonnage was 41,753,897 tons-tons and mail 75,677,866 tons-tons last year. The 1955 passenger load factor was 64.9% compared with 67.4% in 1954.

Total revenues were \$217,431,308, compared with \$205,671,890 for the preceding year.

TWA's profit dropped nearly 50% from \$10,156,000 in 1954 to \$5,467,000 last year.

The airline attributes this to a sizable decline in mail revenue; the loss of two Martin bombers and costs involved in introduction of the Super-C Constellation.

North Central Airlines

North Central reports record passenger revenues of \$4,935,867 last year, a substantial increase over 1954 revenues of \$3,751,712. A decline in mail income produced a smaller increase in total revenues, with 1955 totaling \$5,509,481 and 1954 revenues \$5,534,642. Net profit for the year was \$1,819,449 compared with \$1,111,797 in the previous year. Net profit declined North Central's deficit from \$208,506 to \$80,157.

North Central said it is now the leading local airline in terms of passenger, mail and express carried. Last year it flew 493,445 passengers, 52% more than in the previous year. Air mail volume was up 15% and air express gained 51%. Surface mail traffic increased 18%.

Western Air Lines

Western's total revenues increased from \$24,058,779 in 1954 to \$31,855,523 last year. Net income rose from \$1,493,699 in 1954 to \$1,383,685 in 1955.

Delays paid during the year totaled 90 cents a share.

Western carried a million passengers for the first time last year, with the 1955 total reaching 1,092,578, now gained to \$34,918 in 1954. Passenger miles increased from 822,251,000 in 1954 to 914,677,000 last year. The 1955 passenger load factor was 58.1%, compared with 55.7% in the previous year.

Northeast Airlines

Northeast increased traffic 11.7% to 1,154,410,912 passenger-miles last year. The airline load factor was 59.23% in 1955 and 58.46% in 1954.

Northeast's total revenues rose up from \$8,451,204 in 1954 to \$10,202,140 in the past year.

Operating profit was \$148,157, down slightly from \$169,824 in 1954. Northeast registered a gain of \$177,171 from sale of aircraft which increased its net profit after taxes to \$378,937 for 1955, compared with \$355,112 for the previous year.

The airline attributes the drop in operating profit to a reduction of income from \$2,920,000 in 1954. During the year cost arrangements were made to cover payments on a fleet of 10 DC-6B transports ordered from Douglas aircraft in January 1955.

Seaboard & Western

Seaboard and Western, which will start operations as a combined carrier this month, flew 35,378,600 cargo tons in 1955—27% more than the carrier flew in 1954.

Operating revenues were \$18,479,776, up from \$17,411,194 in 1954. Revenues of \$4,466,142.

Last year the airline's revenue included \$5,039,974 from freight and \$12,789,796 from other sources. Net income was \$1,067,303 compared with a loss of \$64,753 in the previous year of operations.

Seaboard attributes its increased

revenue partly largely to the efficiency of its fleet of five Super Constellation which operated for the first full year in 1955.

The cargo airline has ordered six more Super Constellations for delivery in 1956 and 1957.

\$8500 Million Tax Aid Granted to Airlines

Washington—Aircraft registration gains for rapid tax write-off have been filed with the approval of \$100 million in rapid amortization certificates by the Office of Defense Mobilization. The certificates include 132 turbo-prop aircraft, but none of the largest transport carriers ordered were on the list.

The certificates approved by ODM cover a total of 900 aircraft. The original pool of 600 aircraft was increased 300 units last fall, and the extension now is filed.

In a separate action, the ODM accepted the expansion pool for rapid amortization.

Applications received before Sept. 30, 1955 will now be considered for tax certificates.

When the 600 aircraft expansion pool is added, industry groups asked the ODM to extend it (ENR Aug. 18, 1955, p. 32).

Defense Air Transportation Administration, the agency which administers ODM on air transport aircraft, also recommended that the pool be extended, with an optional lease ODM finally decided on the 300 unit expansion.

Applications were processed in two at that time. Also, 500 additional aircraft have been approved for rapid amortization. If no other transporters are to have the benefits of rapid amortization, the pool will have to be extended again.

DATA, currently in preparing a re-evaluation for ODM.

Turnover of the certificates allow the airlines to write-off 54% of the aircraft value in five years or less on the ground.

Included in the approach were:

• Capital Airlines \$54,175,000 for 60 Vultures

• Delta Air Lines \$26,710,800 for 11 DC-3s

• Eastern Air Lines \$207,662,351 for 37 Lockheed Electras, 28 DC-7Bs and 10 Super-C Constellations. Three of Eastern's only 40 Electras were included when the pool was filed.

• United Air Lines \$15,394,975 for 7 DC-6Bs and 19 DC-3s

• American Airlines \$107,103,605 for 55 Electras, 9 DC-3s and 12 DC-6Bs

• Northwest Airlines \$14,654,434 for 10 DC-6Bs and 10 DC-3s

• Western Air Lines \$15,789,936 for 12 DC-6Bs.



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Airline Income and Expenses—January

(in Dollars)

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Schedule	Total Operating Revenue	Total Operating Expenses	Net Operating Income (Dollars taxed)
DOMESTIC TRUNK								
American	18,810,734	513,735	366,618	1,070,718		20,761,805	18,791,694	1,970,111
Boeing	3,133,695	68,348	43,781	81,294		3,327,118	3,077,000	250,118
Capital	3,666,617	81,748	88,942	12,659		3,949,966	4,430,996	-480,930
Columbia	480,003	7,808	3,269	14,021	45,740	515,841	619,924	-104,083
Continental	1,381,890	21,715	15,123	30,446	117,011	1,556,185	1,381,358	174,827
Delta	4,790,591	926,523	17,554	142,991		5,957,659	4,481,415	1,476,244
Eastern	12,615,805	383,366	173,070	919,993		13,992,234	12,109,808	1,882,426
National	4,780,860	98,598	89,819	180,184		5,149,461	4,243,706	905,755
Northeast	431,480	8,214	5,455	9,952	162,236	616,947	786,148	-169,201
Northwest	5,471,775	114,860	71,685	143,294		5,761,614	4,261,369	1,500,245
TWA World	11,802,325	342,516	272,456	407,090		12,824,387	11,094,677	1,729,710
United	15,364,437	723,674	361,043	640,154		16,810,114	17,281,818	-471,704
Western	705,039	16,266	3,979	9,650		734,934	1,353,351	-618,417
INTERNATIONAL								
American	401,972	14,364	146	41,200		457,682	154,321	303,361
Boeing	435,056	10,546		27,689		473,291	476,172	-2,881
Capital	130,518	1,410		4,301		136,229	121,234	15,000
Columbia	60,449	375		1,601	1,383	62,805	111,546	-48,741
Delta	470,979	5,848		50,524		527,351	484,204	43,147
Eastern	1,640,328	98,768		15,473		1,854,569	1,715,351	139,218
National	479,521	2,894	1,487	6,432		490,334	574,890	-84,556
Northeast	985,194	470,024	4,363	307,343		1,766,924	1,780,134	-13,210
Northwest	247,000	18,000		49,000	109,000	413,000	315,000	98,000
Alaska	4,791,000	140,000		648,000	791,000	5,970,000	5,219,000	751,000
Pacific	3,815,000	671,000		424,000	73,000	4,913,000	4,715,000	198,000
Latin America	5,730,000	991,000		236,000	7,113,000	12,060,000	10,795,000	1,265,000
Panama	1,108,224	70,721		153,995	4,877	1,346,817	1,406,643	-59,826
TWA World	6,281,438	593,879		970,308		7,845,625	6,807,122	1,038,503
United	915,694	758,938		76,380		1,750,012	1,707,133	42,879
LOCAL SERVICE								
Allegany	238,131	10,578	8,943	312	135,876	403,840	485,117	-81,277
Boeing	715,581	8,756	1,583	9,281	81,688	816,309	848,172	-31,863
Capital	66,480	1,045	1,040	9,401	719,276	898,242	953,101	-54,859
Kentucky	50,566	8,791	4,874		116,501	180,732	217,254	-36,522
Lake Central	869,874	1,334	8,800	4,432	54,378	934,818	884,543	50,275
Midwest	488,064	12,237	12,168	144,791		657,260	674,470	-17,210
Omaha	927,680	18,003	6,635		718,417	1,730,735	1,634,884	95,851
Pennsylvania	321,413	7,864	4,198	4,474	101,562	519,511	576,166	-56,655
Southwest	1,190,290	1,313	4,364		143,340	1,339,607	1,261,331	78,276
Southwest	220,129	1,808	3,884	5,090	81,008	312,929	373,277	-60,348
TWA Sevier	191,836		3,842	5,099	970,813	1,161,788	1,054,044	107,744
West Coast	745,846	3,813	8,170	5,211	785,132	1,543,162	1,387,949	155,213
HAWAIIAN								
Boeing	325,897	5,007		42,904	81,297	455,105	498,470	-43,365
Lane Pacific	780,440	793		4,988	4,331	796,562	109,191	687,371
CARGO LINES								
American Mail				1,05,091		105,091	101,373	3,718
Boeing				699,631		699,631	1,106,306	-406,675
Boeing				951,723		951,723	1,070,980	-119,257
Boeing				930		930	947,238	-46,308
HELICOPTER								
N. Y. Airways	10,377	8,718	9,086	9,276	110,848	148,305	120,280	28,025
Los Angeles Airways								
Helicopter Air Service								

* Not available

Compiled by Aviation Week from data furnished by the Civil Aeronautics Board

APRIL 23rd

AIR TRANSPORT Facts and Figures

(PUBLISHED BY THE AIR TRANSPORT ASSOCIATION)

AVIATION WEEK has been officially designated to resume the publication of "Air Transport Facts and Figures," published by the Air Transport Association. This editorial feature will appear in our April 23rd issue and will provide an impressive picture of the tremendous progress achieved by the carriers during the past year. A.T.A. is to be congratulated on making this vitally important editorial feature again available to **AVIATION WEEK**, thus insuring a vastly expanded audience and a world-wide impact.

AVIATION WEEK average net paid ABC circulation June-December, 1955; **54,548**. Paid circulation of current issues; **57,300**. Recent readership research by Advertising Research Foundation shows 1.4 readers for every subscriber copy of **AVIATION WEEK** (readership determined by personal interview using strict recognition test). Current print order **60,670** copies.

Your advertising message scheduled for the April 23, 1956 issue will be fixed to gain maximum attention from all those interested in the Air Transport industry. Regular advertising rates will apply.

AVIATION WEEK

A MCGRAW-HILL PUBLICATION

330 West 42nd Street, New York 36, N. Y.



The Lusitania airplane began service from Philadelphia to New York and Washington and returns in 1932. It carried 38 passengers at an average speed of 110 m.p.h.

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it takes a lot more today



Today's new Boeing 707 transports will carry 450 passengers at speeds in the 575 m.p.h. range, making five hour coast-to-coast, coast-to-coast, coast-to-coast trips.

Bigger loads and higher speeds of tomorrow's airlines take a lot more in bearing performance—**and Shafer Aircraft Bearings are providing it.**

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Double row shown. Also, single row bearing, roller and tapered roller bearings. Design features 14" plus or minus and alignment... many other features without discussion... exceptional shock-load reserve strength.

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See advertisements in this section for a complete description of the various opportunities available in the various fields of the Lockheed Aircraft Corporation.

Positions Vacant
Positions Vacant
Positions Vacant

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—SALARIED—
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Unusual opportunity for qualified engineer with extensive sub-contractor on military aircraft. Good salary expected and close availability.

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Engineers needed to investigate and develop new aircraft standards, coordinate information on type and characteristics of specific products, quantify requirements, production problems, nature of design and nature of supply. Should be capable of ensuring that required proof tests are run and should be able to determine extent of proposed standards to company design and shop practices.

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Immediate opening of right mind and creative mind needed to coordinate and manage a contract administrator. Must be capable of managing a contract administrator. Must be capable of managing a contract administrator. Must be capable of managing a contract administrator.

For further information, please write to: Mr. Mark Peters, Technical Requirements, 331 Peachtree St., N.E., Atlanta, Georgia 30308. Mr. William E. Miller, 331 Peachtree St., N.E., Atlanta, Georgia 30308.

engineers ANNOUNCING EXPANSION OF THE ROCKET ENGINE SECTION of General Electric's Aircraft Gas Turbine Development Department

The performance records of rockets as power plants for expensive missiles and aircraft have led to accelerated design and development activities in this field. Our huge satellite program is now under way. Engineers who wish to contribute to advances in propulsion will be interested in the following openings created by expansion of GE.

ROCKETS

• Design and develop rocket engine valves, seals and piping. Establish and maintain standards and instructions for their manufacture, test, installation and operation.

• Design, develop, construct and test rocket engine seals and piping. Prepare standards and instructions for their manufacture, test and use.

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• Design, develop, construct and test propellant pumps.

• Design, develop, construct and test turbines. Conduct performance analysis.

• Create advanced inlet designs for high performance rockets; provide data on aerodynamic design and performance of such inlets, and conduct theoretical and experimental investigations of designs created.

You'll be working with top men in the field, in small groups which stimulate exchange of ideas. Here, your talents can be easily recognized and rewarded. Educational assistance programs and specialized technical courses are also available to you.

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and
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For further information, please write to:

Mr. Mark Peters
 Technical Requirements
 331 Peachtree St., N.E.
 Atlanta, Georgia 30308
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Here you will encounter instrumentation problems that challenge the state of the art and stimulate your creative ability in Area, Defense and Space techniques.

Your rewards will include all the facilities, equipment and experience at advanced in new frontiers of scientific knowledge...

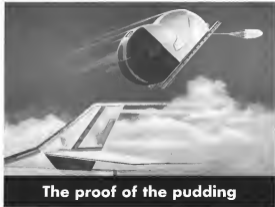
...plus top salary.

Why's more, you'll enjoy the pleasant climate and ideal living on Florida's central east coast, where Patrick Air Force Base, site of the MTP, is located.

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Mr. W. M. Ashby, Technical Development
Missile Test Project, Dept. MC-58
RCA Service Company, Inc., P.O. Box 1326
Melbourne, Florida

RADIO CORPORATION OF AMERICA



The proof of the pudding

Not long ago this long-cooked, light-right recipe recipe for jet aircraft was mostly an idea in the mind of an enthusiastic engineer. Today it is a long, arduous task which will give our pilots added assurance and safety on their important missions as our nation's defenders. What makes this "pudding" also into a reality to accomplish? The answer is creative engineering—our specialty at Goodyear Aircraft—where transforming ideas into working realities has become a habit.

Free ideas are a prime commodity. Imagination and ingenuity are our rare materials. And to help put their ideas to work, our engineers have the most modern facilities available, including one of the world's largest computer laboratories. Here, every idea has a chance.

And many of them make the grade, so the record will show. Both in gases and in war, our engineers have turned their ideas into significant accomplishments that benefit nearly every aircraft in our skies. Aircraft,

missiles, electronic guidance and computing equipment, structural materials, plastics—the list is long and broad. And it's still growing.

This continued growth and diversification demand that our engineering staffs be expanded both at Akron, Ohio, and Wichita, Kansas. Opportunities are selected for creative engineers in all specialties. So, if you have faith in your ideas and confidence in your ability to make them work, don't let a challenging career waiting for you at Goodyear Aircraft.

Solutions and benefits are, of course, liberal. And if you wish to continue your academic studies, company-paid tuition courses leading to advanced degrees are available at nearby colleges.

For further information on your career opportunities at Goodyear Aircraft, write:

Mr. C. G. Jones, Personnel Department, Goodyear Aircraft Corporation, Akron 15, Ohio.

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You'll be working in Ryan and also in other areas. In fact, Ryan is a growing company with a lot of new projects, with lots of new people and new ideas. Ryan's growth is a great opportunity for you to gain experience, broaden your horizons, and gain the satisfaction of working for a growing company.

IMMEDIATE OPENINGS FOR:

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The Ryan Company is looking for a person to assist the manager of the Staff Transfer Department. This position is responsible for the coordination of all staff transfer activities, including the preparation of transfer requests, the review of transfer requests, and the coordination of transfer activities. The position is also responsible for the coordination of all staff transfer activities, including the preparation of transfer requests, the review of transfer requests, and the coordination of transfer activities. The position is also responsible for the coordination of all staff transfer activities, including the preparation of transfer requests, the review of transfer requests, and the coordination of transfer activities.

Manager of Staff Employment,
THE RYAN COMPANY
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441 FIRST NATIONAL BANK BUILDING
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an Announcement to NON-CITIZEN ENGINEERS

from the
GENERAL ELECTRIC COMPANY

High-calibre positions now open for you with the
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U. S. The Aircraft Gas Turbine Division of G.E.

The General Electric Company now offers excellent career opportunities to non-citizen engineers at the Jet & Rocket Center in Cincinnati, Ohio. If you are an Engineering Specialist, with 5 years or more experience in one of the technical areas listed below, we invite your inquiry about these new positions involving advanced work in these fields:

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PRELIMINARY DESIGN • FLUID FLOW
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Ever since this company built the first jet engine in the U.S. in 1942, it has been designing new engines of increasingly greater power and thrust. Among them is the J-47 (over 35,000 of which have been produced for the U.S. Air Force) and the new J-73 (with 9,000 lbs. of thrust).

installed in the F-34H Sabre fighter-bomber. These and other GE jet engines have won many international speed records.

And the jet age is just gathering momentum. New programs are scheduled for years ahead at the Aircraft Gas Turbine Division of General Electric.

Engineers are accorded a high professional status at General Electric. Starting salaries are high. And all GE engineers enjoy a Benefit Program well known for the liberality of its provisions: for graduate study; life, accident and medical insurance; pensions; stock bonus plans.

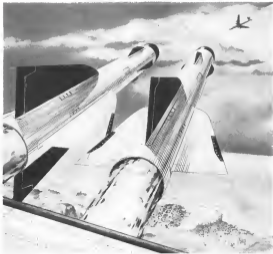
The location of the Aircraft Gas Turbine Division in the suburbs of Cincinnati offers pleasant living conditions. Engineers joining the corporation will be assisted in finding a house or apartment.

INTERVIEWS IN YOUR VICINITY

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Technical Recruiting - Ring, 100 Aircraft Gas Turbine Division

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AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	90	90	90
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	91	91	91
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	92	92	92
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	93	93	93
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	94	94	94
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	95	95	95
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	96	96	96
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	97	97	97
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	98	98	98
AMERICAN AIRCRAFT CORPORATION Aircraft Division, 10000 Aircraft Division, 10000	99	99	99
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